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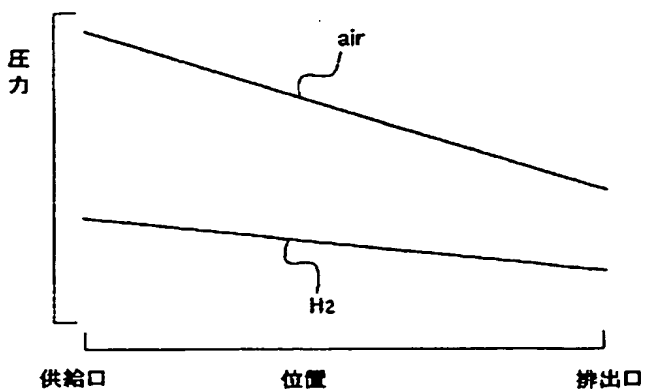
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(54)【発明の名称】 固体高分子型燃料電池

(57)【要約】

【課題】 固体高分子型燃料電池におけるカソードで生じる水を連続的に排除すると共にアノードで必要な水を補給する。

【解決手段】 固体高分子型燃料電池のカソード側に供給される酸素含有ガスとしての空気の圧力を、アノード側に供給される水素含有ガスの圧力より高くする。カソードで生成される水は、空気と水素含有ガスとの圧力差により電解質膜をアノード側に透過する。この水の一部は、アノードで生成されるプロトンが水和物として電解質中をカソード側に移動する際に用いられる。この結果、カソードで生じる水を連続的に排除することができると共にアノードで必要な水を連続的に補給することができ、燃料電池を効率よく連続的に運転することができる。



【特許請求の範囲】

【請求項1】 固体高分子により形成された電解質膜を二つの電極で挟持する固体高分子型燃料電池であって、前記電解質膜の一方側の電極に水素を含有する水素含有ガスを供給する水素含有ガス供給手段と、前記電解質膜の他方側の電極に前記水素含有ガスの供給圧より高い圧力で酸素を含有する酸素含有ガスを供給する酸素含有ガス供給手段とを備える固体高分子型燃料電池。

【請求項2】 前記電解質膜の内部および／または表面に配置され、該電解質膜の強度を補強する補強手段を備える請求項1記載の固体高分子型燃料電池。

【請求項3】 前記補強手段は、前記水素含有ガスと前記酸素含有ガスとの圧力差に応じて前記電解質膜の各部の補強の程度を変えて補強する手段である請求項2記載の固体高分子型燃料電池。

【請求項4】 前記酸素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が小さくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段である請求項1ないし3いずれか記載の固体高分子型燃料電池。

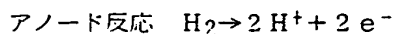
【請求項5】 前記酸素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が大きくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段である請求項1ないし3いずれか記載の固体高分子型燃料電池。

【請求項6】 前記酸素含有ガス供給手段は、前記水素含有ガスの上流側における前記酸素含有ガスと前記水素含有ガスとの圧力差が大きくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段である請求項5記載の固体高分子型燃料電池。

【請求項7】 前記酸素含有ガス供給手段は、前記水素含有ガスの下流側における前記酸素含有ガスと前記水素含有ガスとの圧力差が大きくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段である請求項5記載の固体高分子型燃料電池。

【請求項8】 前記酸素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が小さくなる前記他方側の電極への前記酸素含有ガスの供給と、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が大きくなる前記他方側の電極への前記酸素含有ガスの供給とを切り換える供給切換手段を備える請求項1ないし3いずれか記載の固体高分子型燃料電池。

【請求項9】 前記水素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が小さくなる前記一方側の電極への前記水素含有ガスの供給と、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏



差が大きくなる前記一方側の電極への前記水素含有ガスの供給とを切り換える供給切換手段を備える請求項1ないし3いずれか記載の固体高分子型燃料電池。

【請求項10】 請求項1ないし3いずれか記載の固体高分子型燃料電池であって、前記水素含有ガス供給手段は、前記水素含有ガスが前記一方側の電極の表面を全体として所定方向に流れるよう該水素含有ガスを供給する手段であり、前記酸素含有ガス供給手段は、前記酸素含有ガスが前記他方側の電極の表面を全体として前記所定方向に対して所定の角度をもった方向に流れるよう該酸素含有ガスを供給する手段である固体高分子型燃料電池。

【請求項11】 前記所定の角度をもった方向は、前記所定方向と略同一の方向である請求項10記載の固体高分子型燃料電池。

【請求項12】 前記所定の角度をもった方向は、前記所定方向と略逆方向である請求項10記載の固体高分子型燃料電池。

【請求項13】 前記所定の角度をもった方向は、前記所定方向に対して略直交する方向である請求項10記載の固体高分子型燃料電池。

【請求項14】 前記酸素含有ガス供給手段は、前記所定の角度をもった方向として少なくとも2つの異なる方向を有し、該方向のうちの一つの方角を選択して前記酸素含有ガスを供給する手段である請求項10記載の固体高分子型燃料電池。

【請求項15】 前記水素含有ガス供給手段は、前記所定方向として少なくとも2つの異なる方向を有し、該方向のうちの一つの方角を選択して前記水素含有ガスを供給する手段である請求項10記載の固体高分子型燃料電池。

【発明の詳細な説明】

【0001】

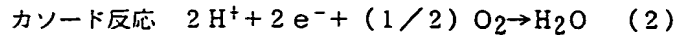
【発明の属する技術分野】本発明は、固体高分子型燃料電池に関し、詳しくは、固体高分子により形成された電解質膜を二つの電極で挟持する固体高分子型燃料電池に関する。

【0002】

【従来の技術】固体高分子型燃料電池では、水素を含有する水素含有ガスと酸素を含有する酸素含有ガスとの供給を受けて、次式(1)および式(2)に示す電極反応により化学エネルギーを直接電気エネルギーに変換する。この電極反応が連続的に円滑に行なわれるためには、アノードでは水素が触媒に連続的に供給されると共に生成するプロトンと水和物として速やかに電解質膜中をカソード側に移動させる必要があり、カソードでは酸素が触媒に連続的に供給されるためにこれを阻害する生成水を連続的に排除する必要がある。

【0003】

(1)



【0004】こうしたカソードで生成する水を排除する固体高分子型燃料電池としては、アノードの水素含有ガス中の水蒸気圧を飽和水蒸気圧より低く維持するものが提案されている（例えば、特許第2703824号など）。この固体高分子型燃料電池では、アノードの水素含有ガス中の水蒸気圧を飽和水蒸気圧より低く維持することにより、酸素含有ガスが供給されるカソードで電気化学反応により生じる生成水を、その濃度勾配によって電解質膜を通過させてカソード側から排除すると共に、アノード側で必要な水の一部を供給することができるとされている。

【0005】

【発明が解決しようとする課題】しかしながら、こうした固体高分子型燃料電池では、カソードでの生成水を十分に排除することができない場合がある。アノード側の水素含有ガス中の水蒸気圧を低くして濃度勾配を生じさせても、濃度勾配に基づく電解質膜における水の移動速度は、カソードで生じる水のすべてを連続的に排除できるほど速くないから、カソードに水が滞ってしまい、水が滞ることによる弊害、即ちカソードにおける酸素の連続的な触媒への供給の阻害を生じてしまう。

【0006】本発明の固体高分子型燃料電池は、カソードで生じる水を連続的に排除することを目的の一つとする。また、本発明の固体高分子型燃料電池は、アノードで必要な水の少なくとも一部をカソードで生成する水で補うことを目的の一つとする。

【0007】

【課題を解決するための手段およびその作用・効果】本発明の固体高分子型燃料電池は、上述の目的の少なくとも一部を達成するために以下の手段を採った。

【0008】本発明の固体高分子型燃料電池は、固体高分子により形成された電解質膜を二つの電極で挟持する固体高分子型燃料電池であって、前記電解質膜の一方側の電極に水素を含有する水素含有ガスを供給する水素含有ガス供給手段と、前記電解質膜の他方側の電極に前記水素含有ガスの供給圧より高い圧力で酸素を含有する酸素含有ガスを供給する酸素含有ガス供給手段とを備えることを要旨とする。

【0009】この本発明の固体高分子型燃料電池では、電解質膜の一方側の電極（アノード）に供給される水素を含有する水素含有ガスの供給圧より高い圧力で電解質膜の他方側の電極（カソード）に酸素を含有する酸素含有ガスを供給することにより、電解質膜のカソード側で生じる生成水を圧力差をもってアノード側に排除すると共に、アノード側で必要な水を補うのである。この結果、カソードにおける酸素の触媒への連続的な供給を確保することができると共に電解質膜における連続的なプロトンの速やかな移動を確保することができ、高性能な燃料電池とすることができる。

【0010】こうした本発明の固体高分子型燃料電池において、前記電解質膜の内部および／または表面に配置され、該電解質膜の強度を補強する補強手段を備えるものとすることもできる。こうすれば、圧力差により生じる電解質膜への負担を軽減することができ、電解質膜の破損を防止することができる。この態様の本発明の固体高分子型燃料電池において、前記補強手段は、前記水素含有ガスと前記酸素含有ガスとの圧力差に応じて前記電解質膜の各部の補強の程度を変えて補強する手段であるものとすることもできる。こうすれば、必要な部位に必要な補強を行なうことができる。

【0011】また、本発明の固体高分子型燃料電池において、前記酸素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が小さくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段であるものとすることもできる。こうすれば、電解質膜の各部における圧力差は略等しくなるから、電解質膜の部分的な耐久性の劣化を防止することができる。

【0012】さらに、本発明の固体高分子型燃料電池において、前記酸素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が大きくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段であるものとすることもできる。こうすれば、電解質膜の各部における圧力差には偏差が生じるから、生成水が多く生じる部位や生成水が滞りやすい部位の圧力差を大きくなるよう調整することにより、こうした部位における生成水を速やかに排除することができると共に他の部位での電解質膜の劣化の促進を防止することができる。この圧力差の偏差が大きくなるよう酸素含有ガスを供給する態様の本発明の固体高分子型燃料電池において、前記酸素含有ガス供給手段は、前記水素含有ガスの上流側における前記酸素含有ガスと前記水素含有ガスとの圧力差が大きくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段であるものとすることもできる。こうすれば、水素含有ガスの上流側で生じる生成水を速やかに排除することができる。また、この圧力差の偏差が大きくなるよう酸素含有ガスを供給する態様の本発明の固体高分子型燃料電池において、前記酸素含有ガス供給手段は、前記水素含有ガスの下流側における前記酸素含有ガスと前記水素含有ガスとの圧力差が大きくなるよう前記他方側の電極に前記酸素含有ガスを供給する手段であるものとしたりすることもできる。こうすれば、水素含有ガスの下流側で生じる生成水を速やかに排除することができる。

【0013】あるいは、本発明の固体高分子型燃料電池において、前記酸素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が小さくなる前記他方側の電極への前記

酸素含有ガスの供給と、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が大きくなる前記他方側の電極への前記酸素含有ガスの供給とを切り換える供給切換手段を備えるものとしたり、前記水素含有ガス供給手段は、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が小さくなる前記一方側の電極への前記水素含有ガスの供給と、前記電解質膜の各部における前記酸素含有ガスと前記水素含有ガスとの圧力差の偏差が大きくなる前記一方側の電極への前記水素含有ガスの供給とを切り換える供給切換手段を備えるものとしたりすることでもできる。こうすれば、固体高分子型燃料電池の状態に応じてカソードでの生成水を排除することができる。

【0014】また、本発明の固体高分子型燃料電池において、前記水素含有ガス供給手段は、前記水素含有ガスが前記一方側の電極の表面を全体として所定方向に流れるよう該水素含有ガスを供給する手段であり、前記酸素含有ガス供給手段は、前記酸素含有ガスが前記他方側の電極の表面を全体として前記所定方向に対して所定の角度をもった方向に流れるよう該酸素含有ガスを供給する手段であるものとするところでもできる。この態様の本発明の固体高分子型燃料電池において、前記所定の角度をもった方向は、前記所定方向と略同一の方向であるものとしたり、前記所定方向と略逆方向であるものとしたり、前記所定方向に対して略直交する方向であるものとしたりすることでもできる。この態様の本発明の固体高分子型燃料電池において、前記酸素含有ガス供給手段は前記所定の角度をもった方向として少なくとも2つの異なる方向を有し該方向のうちの一つの方向を選択して前記酸素含有ガスを供給する手段であるものとしたり、前記水素含有ガス供給手段は前記所定方向として少なくとも2つの異なる方向を有し該方向のうちの一つの方向を選択して前記水素含有ガスを供給する手段であるものとしたりすることでもできる。こうすれば、固体高分子型燃料電池の状態に応じてカソードでの生成水を排除することができる。

【0015】

【発明の実施の形態】次に、本発明の実施の形態を実施例を用いて説明する。図1は本発明の一実施例としての固体高分子型燃料電池10の構成の概略を示す構成図であり、図2は実施例の固体高分子型燃料電池10の燃料電池スタック20の一部を例示する構成図である。固体高分子型燃料電池10は、図1に示すように、単電池21を複数積層してなる燃料電池スタック20を備え、この燃料電池スタック20には酸素を含有する酸素含有ガスとしての空気がブロウ52により供給されると共に水素を含有する水素含有ガスが図示しない水素含有ガスタンクから供給されるようになっている。

【0016】空気の供給管53には、燃料電池スタック20に供給される空気の圧力を調節する供給圧調圧弁5

4が取り付けられており、燃料電池スタック20からの空気の排ガス管58には排圧を調節するための排圧調圧弁59が取り付けられている。水素含有ガスの供給管63にも、燃料電池スタック20に供給される水素含有ガスの圧力を調節する供給圧調圧弁64が取り付けられており、その排ガス管68にも排圧を調節するための排圧調圧弁69が取り付けられている。なお、燃料電池スタック20には、各単電池21における発電に伴う発熱を冷却するために冷却媒体としての水が供給されるようになっている。

【0017】燃料電池スタック20は、図2に示すように、単電池21を複数積層して構成されており、単電池21は、フッ素系樹脂などの高分子材料、例えばDuPont社製のNafion 112により形成されたプロトン導電性の膜体である電解質膜22と、白金または白金と他の金属からなる合金を担持するカーボン粒子を電解質膜22の両表面にスクリーン印刷などにより形成したカソード26およびアノード28と、電解質膜22のカソード26側に配置され酸素を含有する酸素含有ガス（実施例では、空気を使用）の流路としての酸素含有ガス流路34を形成すると共に冷却媒体（実施例では、水を使用）の流路としての冷却媒体流路38を形成する酸素含有ガス側セパレータ30と、電解質膜22のアノード28側に配置され水素を含有する水素含有ガスの流路としての水素含有ガス流路44を形成する水素含有ガス側セパレータ40とにより構成されている。

【0018】図3は、電解質膜22の面方向の断面を例示する断面図である。図示するように、電解質膜22の内部には、電解質膜22の強度を補強する補強部材24が埋め込まれている。この補強部材24は、電解質膜22の電解質としての機能すなわちプロトン導電性機能を損なわない材料、例えばポリテトラフルオロエチレンなどの樹脂などの材料により形成されており、図3に示すように、一方向に偏るようにアンバランスに配置されている。なお、この補強部材24の配置については後述する。

【0019】図4は、酸素含有ガス側セパレータ30の酸素含有ガス流路34が形成される側を例示する平面図である。酸素含有ガス側セパレータ30は、カーボンを圧縮して緻密化しガス不透過とした緻密質カーボンにより形成されており、図示するように、酸素含有ガスとしての空気の供給口31と、空気の排出口35と、供給口31と排出口35とを3列のつづら折り状の溝で連絡するための溝を形成するリブ32とが形成されている。この3列のつづら折り状の溝は、リブ32が電解質膜22に当接することにより前述の酸素含有ガス流路34を形成する。供給口31は、図1に示す空気の供給管53に接続されており、供給圧力が調節された空気が供給されるようになっている。また、排出口35は、空気の排ガス管58に接続されており、排圧が調節された排ガスが

排出されるようになっている。図示しないが、酸素含有ガス側セパレータ30の裏面も、表示面と略同様な構成となっており、燃料電池スタック20に供給される冷却媒体としての水の供給口や排出口、冷却媒体流路38を形成するためのリブ36が形成されている。

【0020】水素含有ガス側セパレータ40も酸素含有ガス側セパレータ30と同一の材料により形成されており、図4に示す酸素含有ガス側セパレータ30の表示面と同一の形状に形成されている。水素含有ガス側セパレータ40の裏面は、何も形成されておらず、平坦になっている。水素含有ガス側セパレータ40に形成された供給口41は、水素含有ガスの供給管63に接続されており、供給圧力が調節された水素含有ガスが供給されるようになっており、排出口45は、水素含有ガスの排ガス管68に接続されており、排圧が調節された排ガスが排出されるようになっている。

【0021】図5は、酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40へ空気や水素含有ガスを供給する際の供給の様子を模式的に例示する説明図である。図示するように、実施例の燃料電池スタック20では、酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40は、その供給口31と供給口41および排出口35と排出口45がそれぞれ整合し、酸素含有ガス流路34と水素含有ガス流路44とが電解質膜22を挟んで同方向に迂流して供給口31や供給口41から排出口35や排出口45に至るように配置されている。

【0022】図6は、実施例の固体高分子型燃料電池10が運転状態にあるときの酸素含有ガス流路34や水素含有ガス流路44における空気や水素含有ガスの圧力の変化の様子を例示する説明図である。実施例の燃料電池スタック20では、酸素含有ガス流路34に流れる空気の圧力が電解質膜22を挟んで水素含有ガス流路44に流れる水素含有ガスの圧力より高くなるように、そして、その圧力差が空気や水素含有ガスの供給口31、41から排出口35、45に向けて小さくなるように供給圧調圧弁54や排圧調圧弁59および供給圧調圧弁64や排圧調圧弁69が調節されている。このように空気と水素含有ガスとに圧力差を設けるのは、電解質膜22のカソード26側表面に上述した式(2)の反応により生じる生成水を電解質膜22中を通してアノード28側に排除するためである。また、供給口31、41近傍における圧力差を排出口35、45近傍における圧力差より大きくしているのは、供給口31、41近傍の水素濃度の高い部位における上述の式(1)および式(2)の反応が活発に行なわれ、これにより生じる多くの生成水をアノード28側に排除するためである。なお、この圧力差の程度は、水の生成の程度や電解質膜22の透水性の程度、電解質膜22の強度などにより設計される。

【0023】前述した電解質膜22内部の補強部材24は、酸素含有ガス流路34に供給される空気と水素含有

ガス流路44に供給される水素含有ガスとに設けられた圧力差に対して電解質膜22を補強するために設けられるものである。図3に示す補強部材24の配置は、圧力差が大きいところで補強力が大きくなるよう補強部材24が密に配置されているのである。

【0024】以上説明した実施例の固体高分子型燃料電池10によれば、電解質膜22に供給する酸素含有ガスとしての空気の供給圧を電解質膜22に供給する水素含有ガスの供給圧より高くすることにより、カソード26で生成する水を電解質膜22を通してアノード28側に排除することができる。このアノード28側への水の移動は、アノード28で生成されるプロトンの電解質膜22の移動に用いられる水を補うことにもなる。したがって、カソード26では生成水を排除することにより空気中の酸素を触媒へ連続的に供給することができ、アノード28では生成したプロトンを速やかに電解質膜22中をカソード26側に移動させることにより水素のプロトン化を連続的に行なうことができる。

【0025】また、実施例の固体高分子型燃料電池10によれば、電解質膜22を補強する補強部材24を備えるから、電解質膜22の強度を増すことができ、電解質膜22の破損や劣化の促進を防止することができる。しかも、補強部材24は空気と水素含有ガスの圧力差に応じて配置されるから、電解質膜22全体を均等にすることができる。

【0026】さらに、実施例の固体高分子型燃料電池10によれば、空気と水素含有ガスの圧力差が空気や水素含有ガスの供給口31、41から排出口35、45に向けて小さくなるように調節したから、供給口31、41近傍の水素濃度の高い部位に生じる多くの生成水をアノード28側に効率的に排除することができる。

【0027】実施例の固体高分子型燃料電池10では、図6に示すように、供給口31、41近傍における空気と水素含有ガスとの圧力差が排出口35、45近傍に比べて大きくなるように調節したが、空気と水素含有ガスとの圧力差が供給口31、41から排出口35、45に向けてほぼ均等になるように調節してもよい。こうすれば、電解質膜22全体が均等な圧力差になるから、カソード26で生じる水を電解質膜22全体で均等に排除することができる。電解質膜22の部分的な劣化や破損を防止することができる。この際には、電解質膜22に埋め込まれる補強部材24は、電解質膜22全体に均等になるように配置される。この変形例は、実施例の固体高分子型燃料電池10の空気の供給管53に取り付けられた供給圧調圧弁54や排ガス管58に取り付けられた排圧調圧弁59、あるいは水素含有ガスの供給管63に取り付けられた供給圧調圧弁64や排ガス管68に取り付けられた排圧調圧弁69を調節するだけで構成できるから、固体高分子型燃料電池10の運転状態に応じて、これらの調圧弁54、59、64、69を調節することに

より、供給口31、41近傍における空気と水素含有ガスとの圧力差が排出口35、45近傍に比べて大きくなる状態と、空気と水素含有ガスとの圧力差が供給口31、41から排出口35、45に向けてほぼ均等になる状態とを切り換えるものとしてもよい。

【0028】また、実施例の燃料電池スタック20では、酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40とを、その供給口31と供給口41および排出口35と排出口45がそれぞれ整合し、酸素含有ガス流路34と水素含有ガス流路44とが電解質膜22を挟んで同方向に迂流して供給口31や供給口41から排出口35や排出口45に至るように配置したが、酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40とを、供給口31と排出口45が整合し、排出口35と供給口41とが整合し、そして酸素含有ガス流路34と水素含有ガス流路44とが電解質膜22を挟んで逆方向に迂流して供給口31や供給口41から排出口35や排出口45に至るように配置してもよい。この配置とした際の酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40の模式図を図7に示し、この配置での運転状態の酸素含有ガス流路34や水素含有ガス流路44における空気や水素含有ガスの圧力の変化の様子の一例を図8に示す。この場合、空気と水素含有ガスは逆方向に流れるから、図8に示すように、空気の供給口31近傍の圧力差が大きく、供給口41近傍の圧力差が小さくなる。こうすれば、空気の排出口35近傍に生じる生成水を効率的に排除することができる。

【0029】酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40の配置方法としては、図9に例示する変形例のように、供給口31と供給口41および排出口35と排出口45とがそれぞれ整合しないようにすると共に全体として空気も水素含有ガスも図中左側から右側へ流れるように酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40を配置したり、図10に例示する変形例のように、図9に例示した水素含有ガス側セパレータ40の供給口41と排出口45を入れ替えて配置するものとしてもよい。図9に例示する変形例では、概ね図5に例示する実施例と同様な流れの方向となるから、図6に例示する圧力変化に近いものとなり、図10に例示する変形例では、概ね図7に例示する変形例と同様な流れの方向となるから、図8に例示する圧力変化に近いものとなる。こうした図9に例示する変形例では実施例と同様な効果を奏し、図10に例示する変形例では図7に例示する変形例と同様な効果を奏するの言うまでもない。

【0030】この他、酸素含有ガス流路34と水素含有ガス流路44とが直交するよう酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40とを配置してもよい。図11は、酸素含有ガス流路34と水素含有ガス流路44とが直交するよう酸素含有ガス側セパレータ3

0と水素含有ガス側セパレータ40とを配置する配置方法を模式的に示す説明図である。図11(a)は酸素含有ガス側セパレータ30の配置であり、図11(b)ないし(e)は図11(a)の酸素含有ガス側セパレータ30に対する水素含有ガス側セパレータ40の配置の4つのパターンである。なお、図11では酸素含有ガス側セパレータ30を基準に水素含有ガス側セパレータ40のパターンを変えて示したが、水素含有ガス側セパレータ40を基準にして酸素含有ガス側セパレータ30のパターンを変えて示しても同一であることは勿論である。図示のいずれのパターンでも、酸素含有ガス側セパレータ30の排出口35近傍における空気の圧力が水素含有ガス側セパレータ40の供給口41近傍の水素含有ガスの圧力より高くなるよう調節することにより、いずれの部位においても空気の圧力の方が水素含有ガスの圧力より大きくすることができるから、カソード26で生成する水をアノード28側に排除することができる。

【0031】実施例の固体高分子型燃料電池10では、空気や水素含有ガスが迂流して流れるよう形成された酸素含有ガス流路34や水素含有ガス流路44を形成する酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40を用いたが、空気や水素含有ガスが一面側から対向する側面に向かって直線的に流れるよう形成された酸素含有ガス流路や水素含有ガス流路を形成する酸素含有ガス側セパレータや水素含有ガス側セパレータを用いるものとしてもよい。このような酸素含有ガス側セパレータの一例を図12に示す。この変形例の酸素含有ガス側セパレータ30Bは、縁を除いて全体が一段掘り下げた状態に形成されており、この掘り下げた部位の前面に断面が円形や矩形の複数の凸部32Bが形成されている。酸素含有ガス側セパレータ30Bでは、この凸部32Bが電解質膜22に当接することにより掘り下げられた部位が空気の流路34Bになる。また、酸素含有ガス側セパレータ30Bの図中左縁近傍には4つの空気の供給口31Bが形成されており、図中右縁近傍には4つの排出口35Bが形成されている。水素含有ガス側セパレータ40Bとして図12に例示する酸素含有ガス側セパレータ30Bと同一形状のものを用いれば、酸素含有ガス側セパレータ30Bと水素含有ガス側セパレータ40Bとの配置のパターンは図13に示す通りとなる。図13では、図13(a)の酸素含有ガス側セパレータ30Bを基準に水素含有ガス側セパレータ40のパターンを図13(b)ないし(d)として示している。このいずれのパターンでも、酸素含有ガス側セパレータ30Bの排出口35B近傍における空気の圧力が水素含有ガス側セパレータ40Bの供給口41B近傍の水素含有ガスの圧力より高くなるよう調節することにより、いずれの部位においても空気の圧力の方が水素含有ガスの圧力より大きくすることができるから、カソード26で生成する水をアノード28側に排除することができる。これらの

パターンのうち図13(b)のパターンを選択すれば、空気と水素含有ガスが平行して同方向に流れるから、流路における圧力の変化は、程度の差はあるもののその形としては図6に例示する実施例と同様な圧力変化を示す。一方、図13(c)のパターンを選択すれば、空気と水素含有ガスが平行して逆方向に流れるから、流路における圧力の変化は、同様に程度の差はあるもののその形としては図8に例示する変形例と同様な圧力変化を示す。

【0032】この他、空気と水素含有ガスの流し方としては、図4に例示する酸素含有ガス側セパレータ30と図12に例示する酸素含有ガス側セパレータ30Bと同一の水素含有ガス側セパレータ40Bとを用いて図14に模式的に示すパターンとしたり、逆に図4に例示する酸素含有ガス側セパレータ30と同一の水素含有ガス側セパレータ40と図12に例示する酸素含有ガス側セパレータ30Bとを用いて図15に模式的に示すパターンとすることもできる。図14および図15に例示するいずれのパターンでも、酸素含有ガス側セパレータ30、30Bの排出口35、35B近傍における空気の圧力が水素含有ガス側セパレータ40B、40の供給口41B、41近傍の水素含有ガスの圧力より高くなるよう調節することにより、いずれの部位においても空気の圧力の方が水素含有ガスの圧力より大きくすることができるから、カソード26で生成する水をアノード28側に排除することができる。

【0033】実施例の固体高分子型燃料電池10では、太さが均一の棒状の補強部材24を用いて電解質膜22を補強するものとしたが、図16に例示する変形例の電解質膜22Cに示すように補強部材24Cを径の変化する棒材を用いるものとしてもよい。この場合、空気と水素含有ガスとの圧力差が大きい部位の径が大きくなるように補強部材24Cを配置するのは言うまでもない。また、図17の変形例の電解質膜22Dに示すように、補間するように補強部材24Dを配置するものとしてもよい。

【0034】実施例の固体高分子型燃料電池10では、補強部材24を電解質膜22に埋め込むものとしたが、図18の変形例の電解質膜22Eや図19の変形例の電解質膜22Fのように補強部材24Eや補強部材24Fを電解質膜22E、22Fに埋め込まず、その表面に配置するものとしてもよい。図18に例示するように補強部材24Eをアノード28側に配置する場合には補強部材24Eを引っ張り強度に有利な材料により形成し、図19に例示するように補強部材24Fをカソード26側に配置する場合には補強部材24Fを圧縮強度に有利な材料により形成すればよい。

【0035】実施例の固体高分子型燃料電池10では、補強部材24として棒材を用いたが、図20の変形例の電解質膜22Gに埋め込まれる補強部材24Gのように短繊維を用いるものとしてもよい。この場合、短繊維は

空気と水素含有ガスとの圧力差に応じて埋め込む量を調節すればよい。

【0036】実施例の固体高分子型燃料電池10では、燃料電池スタック20に一方から空気と水素含有ガスを供給するよう構成しているが、図21の変形例の燃料電池スタック20Hを例示する模式図に示すように、各単電池に交互に図中上からと図中下からとから酸素と水素含有ガスを供給するものとしてもよい。なお、図21では、電解質膜22や酸素含有ガス側セパレータ30、水素含有ガス側セパレータ40を模式的に示している。電解質膜22の厚みが上下で異なるのは、補強部材24の配置によるものであり、図21では電解質膜22を厚い部分が図中上となるものと図中下となるものとを交互に配置して積層している。こうすることにより、変形例の燃料電池スタック20Hを矩形形状に保つことができる。

【0037】実施例の固体高分子型燃料電池10では、図5に例示するように、酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40とを、その供給口31と供給口41および排出口35と排出口45がそれぞれ整合し、酸素含有ガス流路34と水素含有ガス流路44とが電解質膜22を挟んで同方向に迂流して供給口31や供給口41から排出口35や排出口45に至るように配置し、供給口31、41近傍における空気と水素含有ガスとの圧力差が排出口35、45近傍に比べて大きくなるようにしたり、あるいは変形例で示したように空気と水素含有ガスとの圧力差が供給口31、41から排出口35、45に向けてほぼ均等になるようにしたが、この酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40との配置と、図7に例示する酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40との配置、即ち、供給口31と排出口45とが整合し、排出口35と供給口41とが整合し、そして酸素含有ガス流路34と水素含有ガス流路44とが電解質膜22を挟んで逆方向に迂流して供給口31や供給口41から排出口35や排出口45に至る配置とを切り換えて用いるものとしてもよい。この場合、図22の変形例の固体高分子型燃料電池10Jに例示するように、空気を供給口31から供給する配管と排出口35から供給する配管とを切り換えることができるよう構成すればよい。変形例の固体高分子型燃料電池10Jでは、供給管53は、三方弁55、第1供給管56a、三方弁57aを介して燃料電池スタック20Jの水素含有ガスの供給管63側に接続されると共に、三方弁55、第2供給管56b、三方弁57bを介して燃料電池スタック20Jの水素含有ガスの排ガス管68側に接続されている。また、三方弁57a、57bには、排ガス管58a、58bが取り付けられており、排ガス管58a、58bには排圧調圧弁59a、59bが取り付けられている。

【0038】したがって、供給管53と第1供給管56

aとが連通するよう三方弁55を操作し、排ガス管58bと第1供給管56aとが連通しないよう三方弁57aを操作すると共に第2供給管56bと排ガス管58aとが連通しないよう三方弁57bを操作すれば、空気は、供給管53から第1供給管56aを通して燃料電池スタック20Jに供給され、排ガス管58aから排出されるから、図5に例示するパターンとなる。一方、供給管53と第2供給管56bとが連通するよう三方弁55を操作し、排ガス管58aと第2供給管56bとが連通しないよう三方弁57bを操作すると共に第1供給管56aと排ガス管58bとが連通しないよう三方弁57aを操作すれば、空気は、供給管53から第2供給管56bを通して燃料電池スタック20Jに供給され、排ガス管58bから排出されるから、図7に例示するパターンとなる。以上説明したように、この変形例の固体高分子型燃料電池10Jでは、図5に例示するパターンと図7に例示するパターンとを切り換えることができる。この結果、固体高分子型燃料電池10Jの運転状態に応じてより適切なパターンとして運転することができる。なお、変形例の固体高分子型燃料電池10Jでは、図4に例示する酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40を用いたが、図12に例示する酸素含有ガス側セパレータ30Bや水素含有ガス側セパレータ40Bを用いるものとしてもよく、あるいは酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40Bを用いたり、酸素含有ガス側セパレータ30Bと水素含有ガス側セパレータ40を用いるものとしてもよい。

【0039】以上、本発明の実施の形態について実施例を用いて説明したが、本発明はこうした実施例に何等限定されるものではなく、本発明の要旨を逸脱しない範囲内において、種々なる形態で実施し得ることは勿論である。

【図面の簡単な説明】

【図1】 本発明の一実施例としての固体高分子型燃料電池10の構成の概略を示す構成図である。

【図2】 実施例の固体高分子型燃料電池10の燃料電池スタック20の一部を例示する構成図である。

【図3】 電解質膜22の面方向の断面を例示する断面図である。

【図4】 酸素含有ガス側セパレータ30の酸素含有ガス流路34が形成される面を例示する平面図である。

【図5】 酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40へ空気や水素含有ガスを供給する際の供給の様子を模式的に例示する説明図である。

【図6】 実施例の固体高分子型燃料電池10が運転状態にあるときの酸素含有ガス流路34や水素含有ガス流路44における空気や水素含有ガスの圧力の変化の様子を例示する説明図である。

【図7】 変形例における酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40へ空気や水素含有ガ

スを供給する際の供給の様子を模式的に示す説明図である。

【図8】 変形例における運転状態の酸素含有ガス流路34や水素含有ガス流路44の空気や水素含有ガスの圧力の変化の様子を例示する説明図である。

【図9】 変形例における酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40へ空気や水素含有ガスを供給する際の供給の様子を模式的に示す説明図である。

【図10】 変形例における酸素含有ガス側セパレータ30や水素含有ガス側セパレータ40へ空気や水素含有ガスを供給する際の供給の様子を模式的に示す説明図である。

【図11】 酸素含有ガス流路34と水素含有ガス流路44とが直交するよう酸素含有ガス側セパレータ30と水素含有ガス側セパレータ40とを配置する配置方法を模式的に示す説明図である。

【図12】 変形例の酸素含有ガス側セパレータ30Bを例示する説明図である。

【図13】 変形例の酸素含有ガス側セパレータ30Bと水素含有ガス側セパレータ40Bを用いた際の配置のパターンを模式的に例示する説明図である。

【図14】 実施例の酸素含有ガス側セパレータ30と変形例の水素含有ガス側セパレータ40Bとを用いた際の配置のパターンを模式的に例示する説明図である。

【図15】 変形例の酸素含有ガス側セパレータ30Bと実施例の水素含有ガス側セパレータ40とを用いた際の配置のパターンを模式的に例示する説明図である。

【図16】 変形例の補強部材24Cの配置を例示する説明図である。

【図17】 変形例の補強部材24Dの配置を例示する説明図である。

【図18】 変形例の補強部材24Eの配置を例示する説明図である。

【図19】 変形例の補強部材24Fの配置を例示する説明図である。

【図20】 変形例の補強部材24Gを用いる電解質膜22Gを例示する説明図である。

【図21】 変形例の燃料電池スタック20Hを模式的に示す説明図である。

【図22】 変形例の固体高分子型燃料電池10Jの構成の概略を示す構成図である。

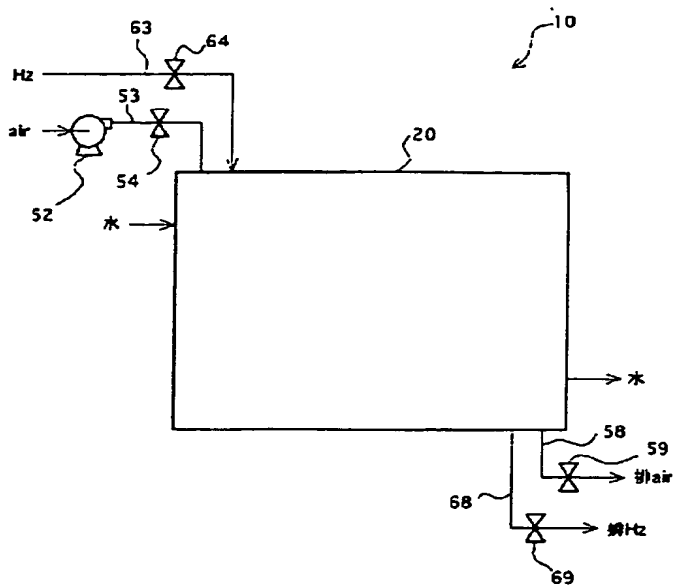
【符号の説明】

10, 10J 固体高分子型燃料電池、20, 20H, 20J 燃料電池スタック、21 単電池、22, 22C, 22D, 22E, 22F, 22G 電解質膜、24, 24C, 24D, 24E, 24F, 24G 補強部材、26 カソード、28 アノード、30, 30B 酸素含有ガス側セパレータ、31, 31B 供給口、32 リブ、32B 凸部、34, 34B 酸素含有ガス流

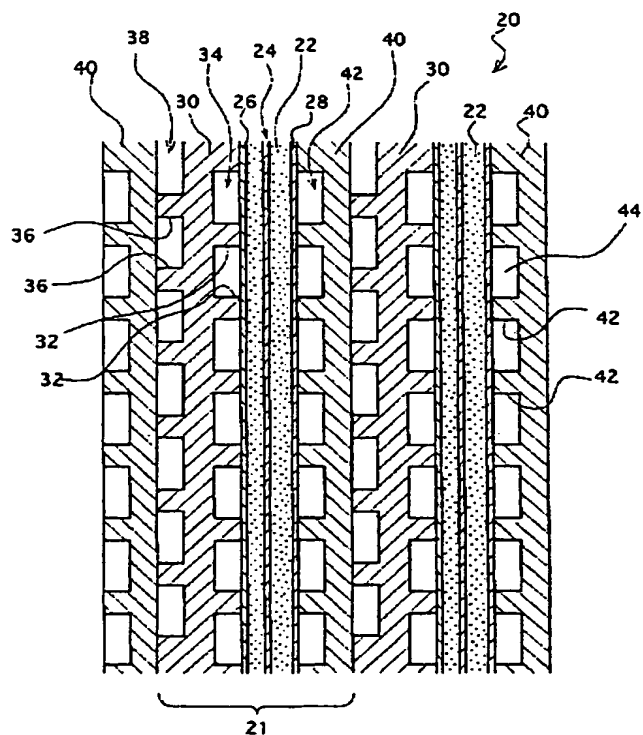
路、35、35B 排出口、36 リブ、38 冷却媒体流路、40、40B 水素含有ガス側セパレータ、41、41B 供給口、42 リブ、44 水素含有ガス流路、45、45B 排出口、52 プロウ、53 供給管、54 供給圧調圧弁、55 三方弁、56a 第

1供給管、56b 第2供給管、57a、57b 三方弁、58、58a、58b 排ガス管、59、59a、59b 排圧調圧弁、63 供給管、64 供給圧調圧弁、68 排ガス管、69 排圧調圧弁。

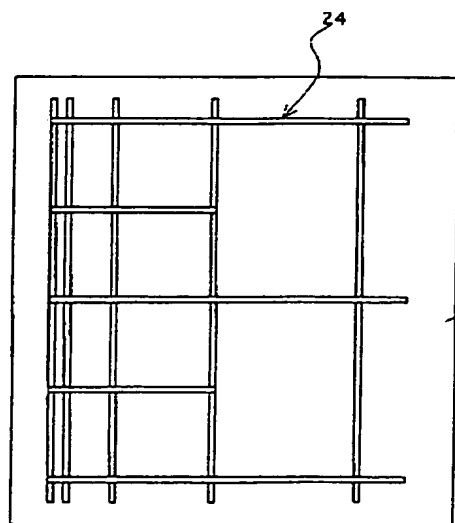
【図1】



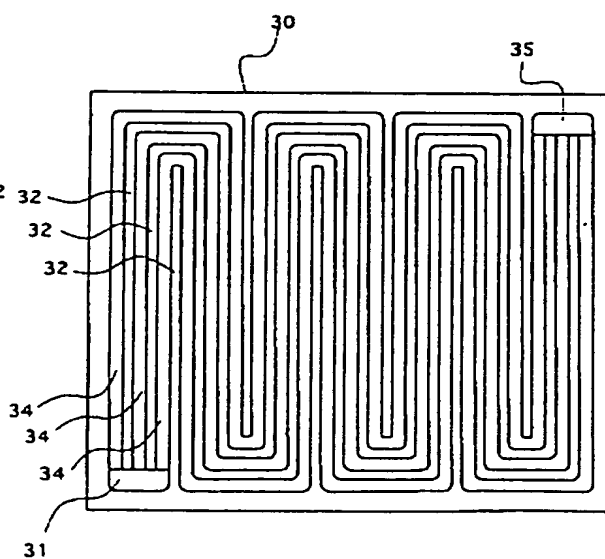
【図2】



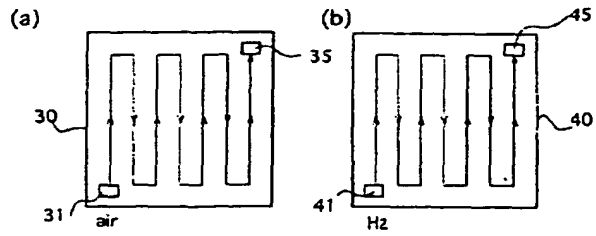
【図3】



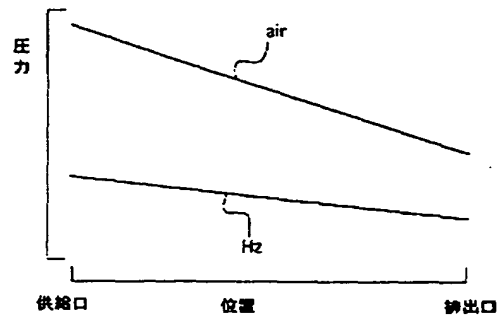
【図4】



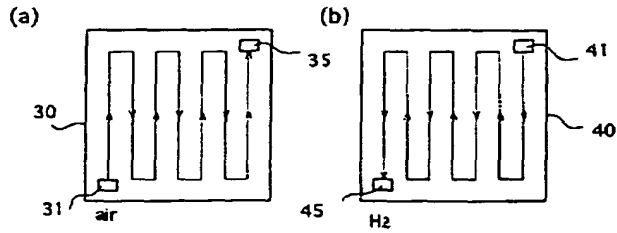
【図5】



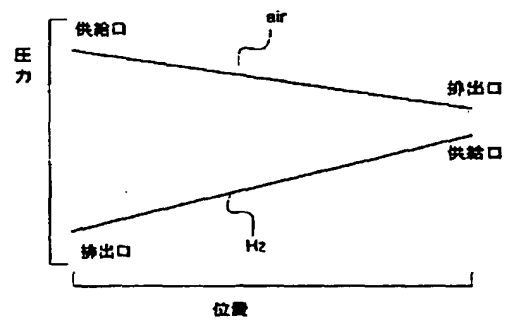
【図6】



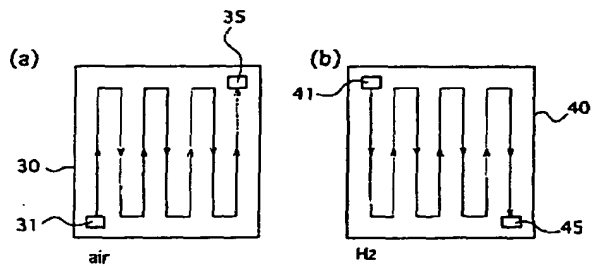
【図7】



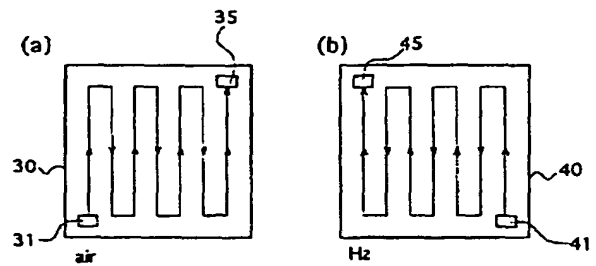
【図8】



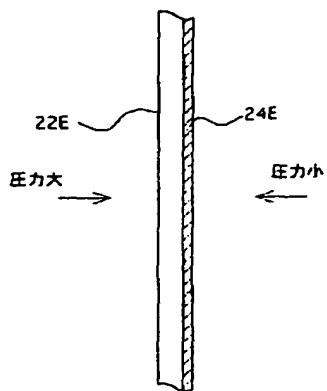
【図9】



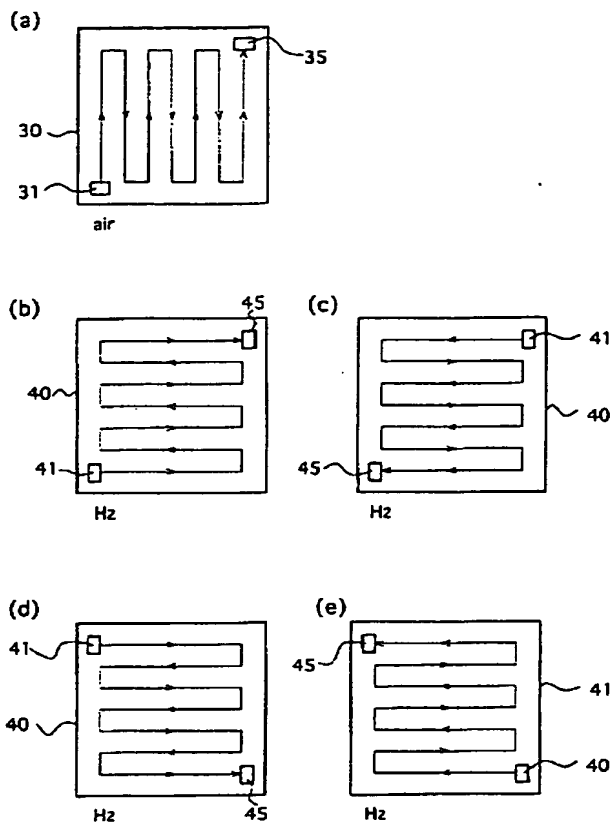
【図10】



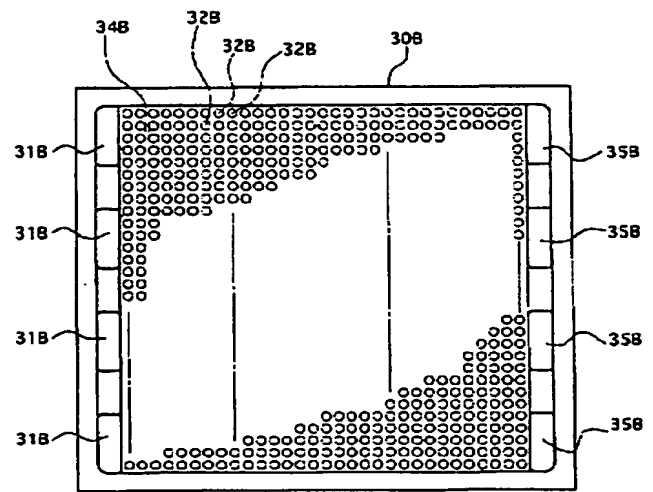
【図18】



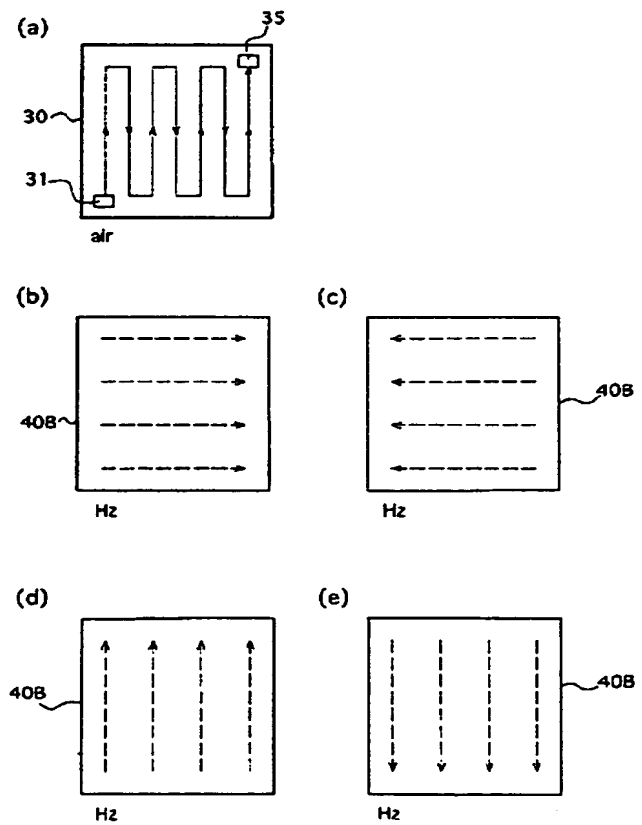
【図11】



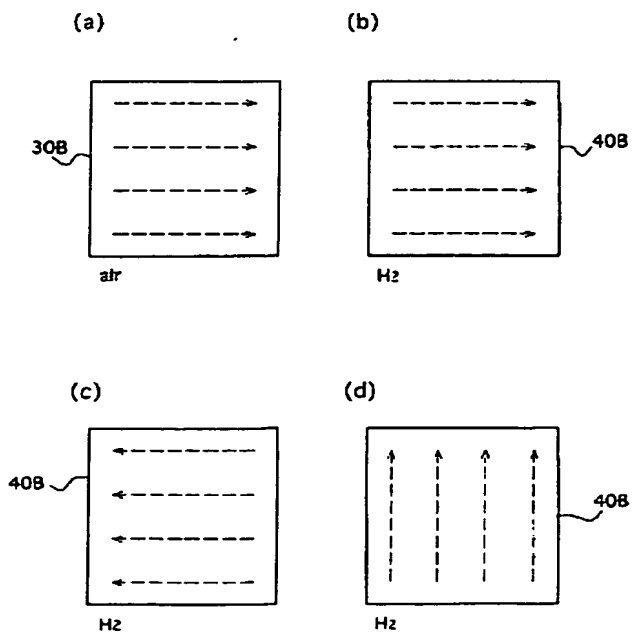
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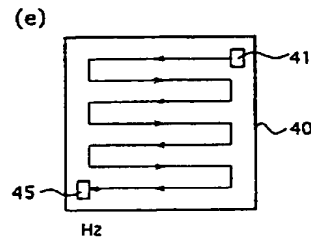
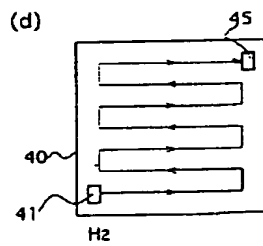
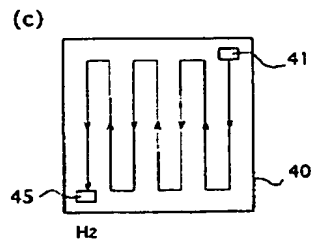
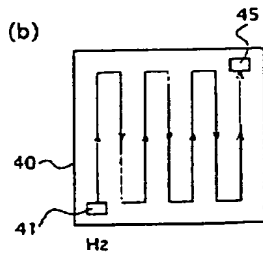
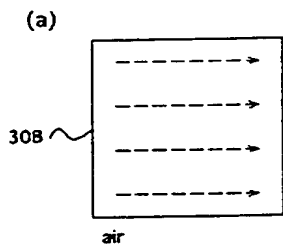
【図14】



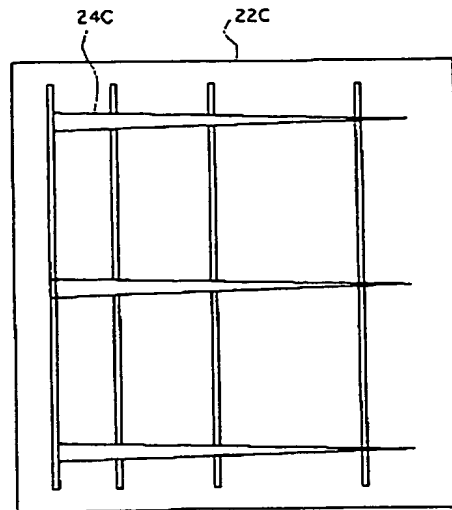
【図13】



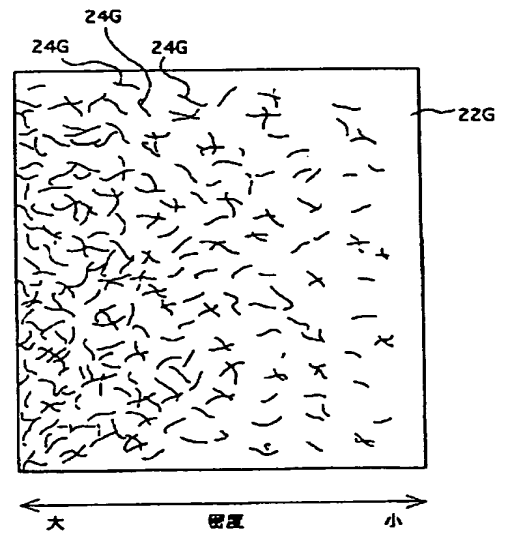
【図15】



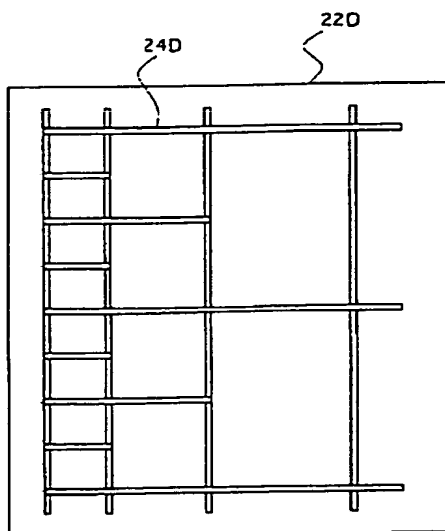
【図16】



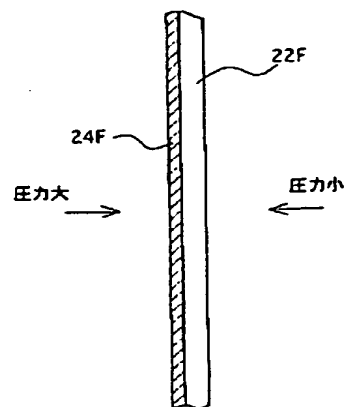
【図20】



【図17】



【図19】



A cross-sectional view of a multi-layered structure. The structure consists of alternating layers of material 22 (hatched) and air (unhatched). The layers are labeled 22, 40, 22, 22, and 20H. A dashed box is shown within the structure, and an arrow points to a layer labeled 20H. The structure is bounded by Hz and air regions.

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Bibliography.

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- (43) [Date of Publication] December 8, Heisei 12 (2000. 12.8)
- (54) [Title of the Invention] Solid-state macromolecule type fuel cell.
- (51) [The 7th edition of International Patent Classification]

H01M 8/04
8/02

8/06

[FI]

H01M 8/04 A
8/02 R
B
8/06 W

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(22) [Filing Date] May 31, Heisei 11 (1999. 5.31)

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[Identification Number] 100075258.

[Patent Attorney]

[Name] Yoshida Kenji (besides two persons)

[Theme code (reference)]

5H026.

5H027.

[F term (reference)]

5H026 AA06 CC03 CC08 CC10.
5H027 AA06 CC06 MM03 MM08.

[Translation done.]

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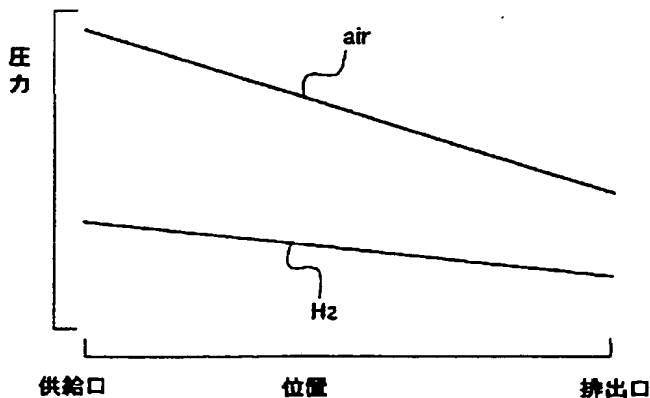
Summary.

(57) [Abstract]

[Technical problem] While eliminating continuously the water produced with the cathode in a solid-state macromolecule type fuel cell, required water is supplied with an anode.

[Means for Solution] The pressure of the air as oxygen content gas supplied to the cathode side of a solid-state macromolecule type fuel cell is made higher than the pressure of the hydrogen content gas supplied at an anode side. The water generated with a cathode penetrates an electrolyte film to an anode side by the pressure differential of air and hydrogen content gas. A part of this water is used in case the proton generated with an anode moves the inside of an electrolyte to a cathode side as a hydrate. Consequently, while being able to eliminate continuously the water produced with a cathode, required water can be continuously supplied with an anode, and a fuel cell can be operated continuously efficiently.

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CLAIMS

[Claim(s)]

[Claim 1] A solid-state macromolecule type fuel cell equipped with a hydrogen content gas-supply means supply the hydrogen content gas which is the solid-state macromolecule type fuel cell which pinches the electrolyte film formed of the solid-state macromolecule by two electrodes, and contains hydrogen in the electrode of one side of the aforementioned electrolyte film, and an oxygen content gas-supply means supply the oxygen content gas which contains oxygen by the pressure higher than the supply pressure of the aforementioned hydrogen content gas in the electrode of the other side of the aforementioned electrolyte film.

[Claim 2] A solid-state macromolecule type fuel cell [equipped with a reinforcement means for it to be arranged on the interior and/or the front face of the aforementioned electrolyte film, and to reinforce the intensity of this electrolyte film] according to claim 1.

[Claim 3] The aforementioned reinforcement means is a solid-state macromolecule type fuel cell according to claim 2 which is a means to change and reinforce the grade of reinforcement of each part of the aforementioned electrolyte film according to the pressure differential of the aforementioned hydrogen content gas and the aforementioned oxygen content gas.

[Claim 4] There is no claim 1 which is a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film may become small, and the aforementioned oxygen content gas supply means is the solid-state macromolecule type fuel cell of a publication 3 either.

[Claim 5] There is no claim 1 which is a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film may become large, and the aforementioned oxygen content gas supply means is the solid-state macromolecule type fuel cell of a publication 3 either.

[Claim 6] The aforementioned oxygen content gas supply means is a solid-state macromolecule type fuel cell according to claim 5 which is a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in the upstream of the aforementioned hydrogen content gas may become large.

[Claim 7] The aforementioned oxygen content gas supply means is a solid-state macromolecule type fuel cell according to claim 5 which is a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in the downstream of the aforementioned hydrogen content gas may become large.

[Claim 8] There is no claim 1 characterized by providing the following, and it is the solid-state macromolecule type fuel cell of a publication 3 either. The aforementioned oxygen content gas supply means is supply of the aforementioned oxygen content gas to the electrode of the aforementioned other side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film becomes small. Supply means for switching which switch supply of the aforementioned oxygen content gas to the electrode of the aforementioned other side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte

film becomes large.

[Claim 9] There is no claim 1 characterized by providing the following, and it is the solid-state macromolecule type fuel cell of a publication 3 either. The aforementioned hydrogen content gas supply means is supply of the aforementioned hydrogen content gas to the electrode of the aforementioned one side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film becomes small. Supply means for switching which switch supply of the aforementioned hydrogen content gas to the electrode of the aforementioned one side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film becomes large.

[Claim 10] There is no claim 1 and it is the solid-state macromolecule type fuel cell of a publication 3 either. the aforementioned hydrogen content gas supply means It is a means to supply this hydrogen content gas so that the aforementioned hydrogen content gas may flow the front face of the electrode of the aforementioned one side in the predetermined direction as a whole. the aforementioned oxygen content gas supply means The solid-state macromolecule type fuel cell which is a means to supply this oxygen content gas so that the aforementioned oxygen content gas may flow the front face of the electrode of the aforementioned other side in the direction which had a predetermined angle to the aforementioned predetermined direction as a whole.

[Claim 11] the direction with the aforementioned predetermined angle — the aforementioned predetermined direction and abbreviation — the solid-state macromolecule type fuel cell according to claim 10 which is the same direction

[Claim 12] The direction with the aforementioned predetermined angle is a solid-state macromolecule type fuel cell according to claim 10 which are the aforementioned predetermined direction and an abbreviation opposite direction.

[Claim 13] The direction with the aforementioned predetermined angle is a solid-state macromolecule type fuel cell according to claim 10 which is the direction which carries out an abbreviation rectangular cross to the aforementioned predetermined direction.

[Claim 14] The aforementioned oxygen content gas supply means is a solid-state macromolecule type fuel cell according to claim 10 which is a means to have at least two different directions as a direction with the aforementioned predetermined angle, to choose the one direction of [of these directions], and to supply the aforementioned oxygen content gas.

[Claim 15] The aforementioned hydrogen content gas supply means is a solid-state macromolecule type fuel cell according to claim 10 which is a means to have at least two different directions as the aforementioned predetermined direction, to choose the one direction of [of these directions], and to supply the aforementioned hydrogen content gas.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[The technical field to which invention belongs] this invention relates to the solid-state macromolecule type fuel cell which pinches the electrolyte film formed of the solid-state macromolecule by two electrodes in detail about a solid-state macromolecule type fuel cell.

[0002]

[Description of the Prior Art] In a solid-state macromolecule type fuel cell, chemical energy is changed into direct electrical energy in response to supply with the hydrogen content gas containing hydrogen, and the oxygen content gas containing oxygen according to the electrode reaction shown in the following formula (1) and a formula (2). In order to perform this electrode reaction smoothly continuously, it is necessary to move the inside of an electrolyte film for the proton generated while hydrogen is continuously supplied to a catalyst in an anode to a cathode side promptly as a hydrate, and in a cathode, since oxygen is continuously supplied to a catalyst, it is necessary to eliminate continuously the generation water which checks this.

[0003]

Anode reaction $H_2 \rightarrow 2H^+ + 2e^-$ (1)

Cathode reaction $2H^+ + 2e^- + (1/2) O_2 \rightarrow H_2O$ (2)

[0004] As a solid-state macromolecule type fuel cell which eliminates the water generated with such a cathode, what maintains lower than saturated-water vapor pressure the water vapor pressure in the hydrogen content gas of an anode is proposed (for example, patent No. 2703824 etc.). In this solid-state macromolecule type fuel cell, while passing an electrolyte film for the generation water produced according to electrochemical reaction in the cathode with which oxygen content gas is supplied by maintaining lower than saturated-water vapor pressure the water vapor pressure in the hydrogen content gas of an anode by the concentration gradient and eliminating from a cathode side, it is supposed that some water required of an anode side can be supplied.

[0005]

[Problem(s) to be Solved by the Invention] However, in such a solid-state macromolecule type fuel cell, the generation water in a cathode may fully be unable to be eliminated. Even if it makes low the water vapor pressure in the hydrogen content gas by the side of an anode and produces a concentration gradient, since it is not so quick as the traverse speed of the water in the electrolyte film based on a concentration gradient can eliminate continuously all the water produced with a cathode, the evil by water being overdue in a cathode and water being overdue, i.e., prevention of supply for the continuous catalyst of the oxygen in a cathode, will be produced.

[0006] The solid-state macromolecule type fuel cell of this invention sets to one of the purposes to eliminate continuously the water produced with a cathode. Moreover, the solid-state macromolecule type fuel cell of this invention sets to one of the purposes with an anode to compensate some required water [at least] with the water generated with a cathode.

[0007]

[A The means for solving a technical problem, and its operation and effect] The solid-state macromolecule type fuel cell of this invention took the following means, in order to attain a part of above-mentioned purpose [at least].

[0008] The solid-state macromolecule type fuel cell of this invention is the solid-state macromolecule type fuel cell which pinches the electrolyte film formed of the solid-state macromolecule by two electrodes, and makes it a summary to have a hydrogen content gas-supply means supply the hydrogen content gas which contains hydrogen in the electrode of one side of the aforementioned electrolyte film, and an oxygen content gas-supply means supply the oxygen content gas which contains oxygen by the pressure higher than the supply pressure of the aforementioned hydrogen content gas in the electrode of the other side of the aforementioned electrolyte film.

[0009] By the solid-state macromolecule type fuel cell of this this invention, while eliminating the generation water produced in the cathode side of an electrolyte film by supplying the oxygen content gas which contains oxygen in the electrode of the other side of an electrolyte film

(cathode) by the pressure higher than the supply pressure of the hydrogen content gas containing the hydrogen supplied to the electrode of one side of an electrolyte film (anode) to an anode side with a pressure differential, required water is compensated with an anode side. Consequently, while continuous supply for the catalyst of the oxygen in a cathode is securable, prompt movement of the continuous proton in an electrolyte film can be secured, and it can be considered as a highly efficient fuel cell.

[0010] In the solid-state macromolecule type fuel cell of such this invention, it shall be arranged on the interior and/or the front face of the aforementioned electrolyte film, and shall have a reinforcement means to reinforce the intensity of this electrolyte film. If it carries out like this, the burden to the electrolyte film produced by the pressure differential can be mitigated, and breakage of an electrolyte film can be prevented. In the solid-state macromolecule type fuel cell of this invention of this mode, the aforementioned reinforcement means shall be a means to change and reinforce the grade of reinforcement of each part of the aforementioned electrolyte film according to the pressure differential of the aforementioned hydrogen content gas and the aforementioned oxygen content gas. If it carries out like this, reinforcement required for a required part can be performed.

[0011] Moreover, in the solid-state macromolecule type fuel cell of this invention, the aforementioned oxygen content gas supply means shall be a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film may become small. If it carries out like this, since the pressure differential in each part of an electrolyte film spreads abbreviation etc., it can prevent degradation of the partial endurance of an electrolyte film.

[0012] Furthermore, in the solid-state macromolecule type fuel cell of this invention, the aforementioned oxygen content gas supply means shall be a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film may become large. While being able to eliminate the generation water in such a part promptly by adjusting the pressure differential of the part which generation water produces, or the part to which generation water tends to be overdue so that it may become large since deflection arises in the pressure differential in each part of an electrolyte film if it carries out like this, promotion of degradation of the electrolyte film in other parts can be prevented. In the solid-state macromolecule type fuel cell of this invention of the mode which supplies oxygen content gas so that the deflection of this pressure differential may become large, the aforementioned oxygen content gas supply means shall be a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in the upstream of the aforementioned hydrogen content gas may become large. If it carries out like this, the generation water produced in the upstream of hydrogen content gas can be eliminated promptly. Moreover, in the solid-state macromolecule type fuel cell of this invention of the mode which supplies oxygen content gas so that the deflection of this pressure differential may become large, the aforementioned oxygen content gas supply means shall be a means to supply the aforementioned oxygen content gas to the electrode of the aforementioned other side so that the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in the downstream of the aforementioned hydrogen content gas may become large. If it carries out like this, the generation water produced in the downstream of hydrogen content gas can be eliminated promptly.

[0013] In the solid-state macromolecule type fuel cell of this invention or the aforementioned oxygen content gas supply means Supply of the aforementioned oxygen content gas to the electrode of the aforementioned other side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film becomes small, Shall have the supply means for switching which switch supply of the aforementioned oxygen content gas to the electrode of the

aforementioned other side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film becomes large, or Supply of the aforementioned hydrogen content gas to the electrode of the aforementioned one side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas becomes small, [in / each part of the aforementioned electrolyte film / in the aforementioned hydrogen content gas supply means] It shall have the supply means for switching which switch supply of the aforementioned hydrogen content gas to the electrode of the aforementioned one side with which the deflection of the pressure differential of the aforementioned oxygen content gas and the aforementioned hydrogen content gas in each part of the aforementioned electrolyte film becomes large. If it carries out like this, the generation water in a cathode can be eliminated according to the state of a solid-state macromolecule type fuel cell.

[0014] In the solid-state macromolecule type fuel cell of this invention moreover, the aforementioned hydrogen content gas supply means It is a means to supply this hydrogen content gas so that the aforementioned hydrogen content gas may flow the front face of the electrode of the aforementioned one side in the predetermined direction as a whole. the aforementioned oxygen content gas supply means It shall be a means to supply this oxygen content gas so that the aforementioned oxygen content gas may flow the front face of the electrode of the aforementioned other side in the direction which had a predetermined angle to the aforementioned predetermined direction as a whole. the direction which had the aforementioned predetermined angle in the solid-state macromolecule type fuel cell of this invention of this mode — the aforementioned predetermined direction and abbreviation — it shall be the direction which carries out [as opposed to / the aforementioned predetermined direction / in that they shall be the aforementioned predetermined direction and an abbreviation opposite direction **** / and] / an abbreviation rectangular cross / that it shall be the same direction In the solid-state macromolecule type fuel cell of this invention of this mode, the aforementioned oxygen content gas supply means shall be a means to have at least two different directions as a direction with the aforementioned predetermined angle, to choose the one direction of [of these directions], and to supply the aforementioned oxygen content gas, or The aforementioned hydrogen content gas supply means shall be a means to have at least two different directions as the aforementioned predetermined direction, to choose the one direction of [of these directions], and to supply the aforementioned hydrogen content gas. If it carries out like this, the generation water in a cathode can be eliminated according to the state of a solid-state macromolecule type fuel cell.

[0015]

[Embodiments of the Invention] Next, the gestalt of operation of this invention is explained using an example. Drawing 1 is the block diagram showing the outline of the composition of the solid-state macromolecule type fuel cell 10 as one example of this invention, and drawing 2 is a block diagram which illustrates a part of fuel cell stack 20 of the solid-state macromolecule type fuel cell 10 of an example. As shown in drawing 1, the solid-state macromolecule type fuel cell 10 is equipped with the fuel cell stack 20 which carries out two or more laminatings of the cell 21, and becomes, and it is supplied from the hydrogen content gas holder which the hydrogen content gas containing hydrogen does not illustrate while the air as oxygen content gas containing oxygen is supplied to this fuel cell stack 20 by the blower 52.

[0016] The supply-pressure pressure regulating valve 54 which adjusts the pressure of the air supplied to the fuel cell stack 20 is attached in the air supply pipe 53, and the exhaust-gas-pressure pressure regulating valve 59 for adjusting exhaust gas pressure is attached in the exhaust gas pipe 58 of the air from the fuel cell stack 20. The supply-pressure pressure regulating valve 64 which adjusts the pressure of the hydrogen content gas supplied to the fuel cell stack 20 is attached also in the supply pipe 63 of hydrogen content gas, and the exhaust-gas-pressure pressure regulating valve 69 for adjusting exhaust gas pressure also to the exhaust gas pipe 68 is attached. In addition, in order to cool generation of heat accompanying the power generation in each cell 21, the water as a cooling medium is supplied to the fuel cell stack 20.

[0017] Two or more laminations of the cell 21 are carried out, and the fuel cell stack 20 is constituted, as shown in drawing 2. a cell 21 Nafion of polymeric materials made from DuPont, such as a fluorine system resin, for example, a product. The electrolyte film 22 which is the membrane of proton conductivity formed of 112. The cathode 26 and anode 28 which formed in both the front faces of the electrolyte film 22 the carbon particle which supports the alloy which consists of platinum or platinum, and other metals by screen-stencil etc., Oxygen content gas which is arranged at the cathode 26 side of the electrolyte film 22, and contains oxygen (in the example) While forming the oxygen content gas passageway 34 as passage of use of air, it is a cooling medium (in the example). The oxygen content gas side separator 30 which forms the cooling-medium passage 38 as passage of use of water, It is constituted by the hydrogen content gas side separator 40 which forms the hydrogen content gas passageway 44 as passage of the hydrogen content gas which is arranged at the anode 28 side of the electrolyte film 22, and contains hydrogen.

[0018] Drawing 3 is a cross section which illustrates the cross section of the direction of a field of the electrolyte film 22. the reinforcement which reinforces the intensity of the electrolyte film 22 inside the electrolyte film 22 so that it may illustrate — the member 24 is embedded this reinforcement — the member 24 is formed of material, such as resins, such as the material not spoiling, the function, i.e., the proton conductivity function, as an electrolyte of the electrolyte film 22, for example, a polytetrafluoroethylene etc., and as shown in drawing 3, it is arranged out of balance so that it may incline toward ** on the other hand in addition, this reinforcement — about arrangement of a member 24, it mentions later

[0019] Drawing 4 is a plan which illustrates the side in which the oxygen content gas passageway 34 of the oxygen content gas side separator 30 is formed. It is formed with the substantially-compact carbon which the oxygen content gas side separator 30 compressed carbon, and turned precisely, and it presupposed gas un-penetrating, and the rib 32 which forms the slot for connecting the air supply mouth 31 as oxygen content gas, the exhaust port 35 of air, and a feed hopper 31 and an exhaust port 35 in the slot of the shape of a winding path of three trains is formed so that it may illustrate. The slot of the shape of a winding path of these three trains forms the above-mentioned oxygen content gas passageway 34, when a rib 32 contacts the electrolyte film 22. The feed hopper 31 is connected to the air supply pipe 53 shown in drawing 1, and the air by which the supply pressure was adjusted is supplied. Moreover, the exhaust port 35 is connected to the exhaust gas pipe 58 of air, and the exhaust gas by which exhaust gas pressure was adjusted is discharged. Although not illustrated, the rear face of the oxygen content gas side separator 30 also has the screen and the same composition as abbreviation, and the rib 36 for forming the feed hopper and exhaust port of the water as a cooling medium supplied to the fuel cell stack 20, and the cooling-medium passage 38 is formed.

[0020] The hydrogen content gas side separator 40 is also formed of the same material as the oxygen content gas side separator 30, and is formed in the same configuration as the screen of the oxygen content gas side separator 30 shown in drawing 4. No rear faces of the hydrogen content gas side separator 40 are formed, but are flat. The feed hopper 41 formed in the hydrogen content gas side separator 40 is connected to the supply pipe 63 of hydrogen content gas, the hydrogen content gas by which the supply pressure was adjusted is supplied, the exhaust port 45 is connected to the exhaust gas pipe 68 of hydrogen content gas, and the exhaust gas by which exhaust gas pressure was adjusted is discharged.

[0021] Drawing 5 is explanatory drawing which illustrates typically the situation of the supply at the time of supplying air and hydrogen content gas to the oxygen content gas side separator 30 or the hydrogen content gas side separator 40. By the fuel cell stack 20 of an example, the feed hopper 31 and feed hopper 41 and an exhaust port 35, and an exhaust port 45 adjust the oxygen content gas side separator 30 and the hydrogen content gas side separator 40, respectively, and they are arranged so that the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 may carry out a ** style in this direction on both sides of the electrolyte film 22 and may result [from a feed hopper 31 or a feed hopper 41] in an exhaust port 35 or an exhaust port 45 so that it may illustrate.

[0022] Drawing 6 is explanatory drawing which illustrates the situation of change of the pressure

of the air in the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 in case the solid-state macromolecule type fuel cell 10 of an example is in operational status, or hydrogen content gas. In the fuel cell stack 20 of an example, the supply-pressure pressure regulating valve 54, the exhaust-gas-pressure pressure regulating valve 59 and the supply-pressure pressure regulating valve 64, and the exhaust-gas-pressure pressure regulating valve 69 are adjusted so that the pressure of the air which flows to the oxygen content gas passageway 34 may become higher than the pressure of the hydrogen content gas which flows to the hydrogen content gas passageway 44 on both sides of the electrolyte film 22, and so that the pressure differential may become small towards the feed hoppers 31 and 41 of air or hydrogen content gas to the exhaust ports 35 and 45. Thus, a pressure differential is prepared in air and hydrogen content gas for eliminating [be / under / electrolyte film 22 / passing / it] the generation water produced by the reaction of the formula (2) mentioned above on the cathode 26 side front face of the electrolyte film 22 to an anode 28 side. Moreover, the pressure differential in 31 or about 41 feed hopper is made larger than the pressure differential in 35 or about 45 exhaust port for eliminating much generation water which the reaction of the above-mentioned formula (1) in a part with 31 or about 41-feed hopper high hydrogen concentration and a formula (2) is actively performed, and this produces to an anode 28 side. In addition, the grade of this pressure differential is designed by the grade of generation of water, the permeable grade of the electrolyte film 22, the intensity of the electrolyte film 22, etc.

[0023] reinforcement of the electrolyte film 22 interior mentioned above — a member 24 is formed in order to reinforce the electrolyte film 22 to the pressure differential prepared in the air supplied to the oxygen content gas passageway 34, and the hydrogen content gas supplied to the hydrogen content gas passageway 44 the reinforcement shown in drawing 3 — the reinforcement force becomes large in the place where arrangement of a member 24 has a large pressure differential — as — reinforcement — the member 24 is arranged densely

[0024] According to the solid-state macromolecule type fuel cell 10 of an example explained above, the water generated with a cathode 26 can be eliminated to an anode 28 side through the electrolyte film 22 by making it higher than the supply pressure of the hydrogen content gas which supplies the supply pressure of the air as oxygen content gas supplied to the electrolyte film 22 to the electrolyte film 22. Movement of the water by the side of this anode 28 also becomes compensating the water used for movement of the electrolyte film 22 of the proton generated with an anode 28. Therefore, with a cathode 26, by eliminating generation water, the oxygen in air can be continuously supplied to a catalyst, and hydrogen can be continuously protonated with an anode 28 by moving the inside of the electrolyte film 22 for the generated proton to a cathode 26 side promptly.

[0025] moreover, the reinforcement which reinforces the electrolyte film 22 according to the solid-state macromolecule type fuel cell 10 of an example — since it has a member 24, the intensity of the electrolyte film 22 can be increased and breakage of the electrolyte film 22 and promotion of degradation can be prevented and reinforcement — since a member 24 is arranged according to the pressure differential of air and hydrogen content gas, it can equalize the electrolyte film 22 whole

[0026] Furthermore, according to the solid-state macromolecule type fuel cell 10 of an example, since it adjusted so that the pressure differential of air and hydrogen content gas might become small towards the feed hoppers 31 and 41 of air or hydrogen content gas to the exhaust ports 35 and 45, much generation water produced to a part with 31 or about 41-feed hopper high hydrogen concentration can be efficiently eliminated to an anode 28 side.

[0027] Although it adjusted in the solid-state macromolecule type fuel cell 10 of an example so that the pressure differential of the air and hydrogen content gas in 31 or about 41 feed hopper might become large compared with 35 or about 45 exhaust port as shown in drawing 6, you may adjust so that the pressure differential of air and hydrogen content gas may become almost equal towards feed hoppers 31 and 41 to the exhaust ports 35 and 45. If it carries out like this, since the electrolyte film 22 whole becomes an equal pressure differential, the water produced with a cathode 26 can be equally eliminated by the electrolyte film 22 whole. Partial degradation and partial breakage of the electrolyte film 22 can be prevented. in this case, the reinforcement

embedded on the electrolyte film 22 — a member 24 is arranged so that it may become equal at the electrolyte film 22 whole. This modification The exhaust-gas-pressure pressure regulating valve 69 attached in the exhaust-gas-pressure pressure regulating valve 59 attached in the supply-pressure pressure regulating valve 54 attached in the air supply pipe 53 of the solid-state macromolecule type fuel cell 10 of an example, or the exhaust gas pipe 58 or the supply-pressure pressure regulating valve 64 attached in the supply pipe 63 of hydrogen content gas, or the exhaust gas pipe 68. Since it can constitute only from adjusting, according to the operational status of the solid-state macromolecule type fuel cell 10, by adjusting these pressure regulating valves 54, 59, 64, and 69. It is good also as that to which the pressure differential of the state where the pressure differential of the air and hydrogen content gas in 31 or about 41 feed hopper becomes large compared with 35 or about 45 exhaust port, and air and hydrogen content gas switches the state of becoming almost equal towards exhaust ports 35 and 45, from feed hoppers 31 and 41.

[0028] In the fuel cell stack 20 of an example, moreover, the oxygen content gas side separator 30 and the hydrogen content gas side separator 40. Although it has arranged so that the feed hopper 31 and feed hopper 41 and an exhaust port 35, and an exhaust port 45 may have consistency, respectively, the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 may carry out a ** style in this direction on both sides of the electrolyte film 22 and it may result [from a feed hopper 31 or a feed hopper 41] in an exhaust port 35 or an exhaust port 45. The oxygen content gas side separator 30 and the hydrogen content gas side separator 40. You may arrange so that a feed hopper 31 and an exhaust port 45 may have consistency, and an exhaust port 35 and a feed hopper 41 may have consistency, and the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 may carry out a ** style to an opposite direction on both sides of the electrolyte film 22 and it may result [from a feed hopper 31 or a feed hopper 41] in an exhaust port 35 or an exhaust port 45. The ** type view of the oxygen content gas side separator 30 at the time of considering as this arrangement and the hydrogen content gas side separator 40 is shown in drawing 7, and an example of the situation of change of the pressure of the air in the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 of operational status in this arrangement or hydrogen content gas is shown in drawing 8. In this case, since air and hydrogen content gas flow to an opposite direction, as they are shown in drawing 8, an about 31 air supply mouth pressure differential is large, and an about 41-feed hopper pressure differential becomes small. If it carries out like this, the generation water produced in about 35 exhaust port of air can be eliminated efficiently.

[0029] As a configuration method of the oxygen content gas side separator 30 or the hydrogen content gas side separator 40. Like the modification illustrated to drawing 9. So that air and hydrogen content gas may also flow from the left-hand side in drawing to right-hand side as a whole, while making it a feed hopper 31, a feed hopper 41 and an exhaust port 35, and an exhaust port 45 not have consistency, respectively arrange the oxygen content gas side separator 30 and the hydrogen content gas side separator 40, or It is good also as what replaces and arranges the feed hopper 41 and exhaust port 45 of the hydrogen content gas side separator 40 which were illustrated to drawing 9 like the modification illustrated to drawing 10. It becomes a thing near [since it becomes the same flow direction as the example illustrated in general to drawing 5 in the modification illustrated to drawing 9] the pressure variation illustrated to drawing 6, and in the modification illustrated to drawing 10, since it becomes the same flow direction as the modification illustrated in general to drawing 7, it becomes a thing near the pressure variation illustrated to drawing 8. Doing so the same effect as an example in the modification illustrated to such drawing 9, and doing so the same effect as the modification illustrated to drawing 7 in the modification illustrated to drawing 10 cannot be overemphasized.

[0030] In addition, you may arrange the oxygen content gas side separator 30 and the hydrogen content gas side separator 40 so that the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 may intersect perpendicularly. Drawing 11 is explanatory drawing showing typically the configuration method which arranges the oxygen content gas side separator 30 and the hydrogen content gas side separator 40 so that the oxygen content gas

passageway 34 and the hydrogen content gas passageway 44 may intersect perpendicularly. Drawing 11 (a) is arrangement of the oxygen content gas side separator 30, and drawing 11 (b) or (e) are four patterns of arrangement of the hydrogen content gas side separator 40 to the oxygen content gas side separator 30 of drawing 11 (a). In addition, although drawing 11 changed and showed the pattern of the hydrogen content gas side separator 40 on the basis of the oxygen content gas side separator 30, the same thing is natural even if the pattern of the oxygen content gas side separator 30 is changed and shown on the basis of the hydrogen content gas side separator 40. Since the pressure of air can make any pattern of illustration larger than the pressure of hydrogen content gas also in which part by adjusting so that the pressure of the air in about 35 exhaust port of the oxygen content gas side separator 30 may become higher than the pressure of about 41 feed hopper [of the hydrogen content gas side separator 40] hydrogen content gas, the water generated with a cathode 26 can be eliminated to an anode 28 side.

[0031] Although the oxygen content gas side separator 30 which forms the oxygen content gas passageway 34 formed so that air and hydrogen content gas might carry out in the style of ** and might flow, and the hydrogen content gas passageway 44, and the hydrogen content gas side separator 40 were used in the solid-state macromolecule type fuel cell 10 of an example It is good also as a thing using the oxygen content gas side separator which forms the oxygen content gas passageway formed so that air and hydrogen content gas might flow linearly toward the side which counters from an unilateral side, and a hydrogen content gas passageway, or hydrogen content gas side separator. An example of such oxygen content gas side separator is shown in drawing 12 . Oxygen content gas side separator 30B of this modification is formed in the state where the whole investigated one step except for the edge, and heights 32B of the plurality [cross section] of a round shape or a rectangle is formed in the front face of this investigated part. In oxygen content gas side separator 30B, the part investigated when this heights 32B contacted the electrolyte film 22 is set to passage 34B of air. Moreover, near the left brink in drawing of oxygen content gas side separator 30B, four air supply mouth 31B is formed, and four exhaust port 35B is formed near the drawing Nakamigi edge. If the thing of the same configuration as oxygen content gas side separator 30B illustrated to drawing 12 as hydrogen content gas side separator 40B is used, the pattern [B / hydrogen content gas side separator 40/ oxygen content gas side separator 30B and] of arrangement will become as it is shown in drawing 13 . Drawing 13 shows the pattern of the hydrogen content gas side separator 40 as drawing 13 (b) or (d) on the basis of oxygen content gas side separator 30B of drawing 13 (a). Since the pressure of air can make any of this pattern larger than the pressure of hydrogen content gas also in which part by adjusting so that the pressure of air [near the exhaust port 35B of oxygen content gas side separator 30B] may become higher than the pressure of the hydrogen content gas near the feed-hopper 41B of hydrogen content gas side separator 40B, the water generated with a cathode 26 can be eliminated to an anode 28 side. If the pattern of drawing 13 (b) is chosen among these putters, since hydrogen content gas will be parallel to air and it will flow in this direction, the same pressure variation as the example as which change of the pressure in passage illustrates the difference of a grade to drawing 6 as the form of a certain thing is shown. On the other hand, if the pattern of drawing 13 (c) is chosen, since hydrogen content gas will be parallel to air and it will flow to an opposite direction, the same pressure variation as the modification as which change of the pressure in passage illustrates the difference of a grade to drawing 8 as the form of a certain thing similarly is shown.

[0032] in addition, as how to pass air and hydrogen content gas Consider as the pattern typically shown in drawing 14 using oxygen content gas side separator 30B illustrated to the oxygen content gas side separator 30 illustrated to drawing 4 , and drawing 12 , and the same hydrogen content gas side separator 40B, or Conversely, it can also consider as the pattern typically shown in drawing 15 using oxygen content gas side separator 30B illustrated to the same hydrogen content gas side separator 40 and the same drawing 12 as the oxygen content gas side separator 30 illustrated to drawing 4 . Any pattern illustrated to drawing 14 and drawing 15 By adjusting so that the pressure of air [the exhaust port 35 of the oxygen content gas side separator 30 and 30B and near the 35B] may become higher than the pressure of feed-hopper

41B of the hydrogen content gas side separator 40B and 40, and about 41 hydrogen content gas. Since the pressure of air can make it larger than the pressure of hydrogen content gas also in which part, the water generated with a cathode 26 can be eliminated to an anode 28 side.

[0033] the cylindrical reinforcement with a size uniform in the solid-state macromolecule type fuel cell 10 of an example — although the electrolyte film 22 shall be reinforced using a member 24, it is shown in electrolyte film 22C of the modification illustrated to drawing 16 — as — reinforcement — a member — it is good also as a thing using the bar from which a path changes 24C in this case, the path of a part with the large pressure differential of air and hydrogen content gas becomes large — as — reinforcement — a member — arranging 24C cannot be overemphasized moreover, as shown in electrolyte film 22D of the modification of drawing 17, it interpolates — as — reinforcement — a member — it is good also as what arranges 24D

[0034] the solid-state macromolecule type fuel cell 10 of an example — reinforcement — although a member 24 shall be embedded on the electrolyte film 22 — electrolyte film 22F of the modification of electrolyte film 22E of the modification of drawing 18, or drawing 19 — like — reinforcement — a member — 24E and reinforcement — a member — it is good also as what does not embed 24F on the electrolyte films 22E and 22F, but is arranged on the front face it illustrates to drawing 18 — as — reinforcement — a member — the case where 24E is arranged to an anode 28 side — reinforcement — a member — 24E is formed by material advantageous to tensile strength, and it illustrates to drawing 19 — as — reinforcement — a member — the case where 24F are arranged to a cathode 26 side — reinforcement — a member — what is necessary is just to form 24F by material advantageous to compressive strength

[0035] the solid-state macromolecule type fuel cell 10 of an example — reinforcement — the reinforcement embedded electrolyte film 22G of the modification of drawing 20 although the bar was used as a member 24 — a member — it is good also as a thing using a staple fiber like 24G. In this case, a staple fiber should just adjust the amount embedded according to the pressure differential of air and hydrogen content gas.

[0036] Although it constitutes from a solid-state macromolecule type fuel cell 10 of an example so that air and hydrogen content gas may be supplied to the fuel cell stack 20 from Mukai on the other hand, as shown in the ** type view which illustrates fuel cell stack 20H of the modification of drawing 21, it is good also as what supplies the shell oxygen from drawing Nakashita from drawing Nakagami, and hydrogen content gas to each cell by turns. In addition, drawing 21 shows typically the electrolyte film 22, the oxygen content gas side separator 30, and the hydrogen content gas side separator 40. the thickness of the electrolyte film 22 differs by the upper and lower sides — reinforcement — it is based on arrangement of a member 24, and in drawing 21, what serves as that from which a thick portion serves as drawing Nakagami in the electrolyte film 22, and drawing Nakashita is arranged by turns, and is carrying out the laminating. By carrying out like this, fuel cell stack 20H of a modification can be maintained at a rectangle configuration.

[0037] In the solid-state macromolecule type fuel cell 10 of an example, so that it may illustrate to drawing 5 the oxygen content gas side separator 30 and the hydrogen content gas side separator 40. The feed hopper 31 and feed hopper 41 and an exhaust port 35, and an exhaust port 45 have consistency, respectively. It arranges so that the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 may carry out a ** style in this direction on both sides of the electrolyte film 22 and may result [from a feed hopper 31 or a feed hopper 41] in an exhaust port 35 or an exhaust port 45. Although it is made to become large or was made for the pressure differential of air and hydrogen content gas to become almost equal towards feed hoppers 31 and 41 to the exhaust ports 35 and 45 as the pressure differential of the air and hydrogen content gas in 31 or about 41 feed hopper showed in the modification compared with 35 or about 45 exhaust port. Arrangement with this oxygen content gas side separator 30 and the hydrogen content gas side separator 40, Arrangement with the oxygen content gas side separator 30 illustrated to drawing 7, and the hydrogen content gas side separator 40, Namely, a feed hopper 31 and an exhaust port 45 have consistency, and an exhaust port 35 and a feed hopper 41 have consistency. And it is good also as what switches and uses arrangement from a feed hopper 31 or a feed hopper 41 to [arrangement / the oxygen

content gas passageway 34 and the hydrogen content gas passageway 44 carry out a ** style to an opposite direction on both sides of the electrolyte film 22, and] an exhaust port 35 or an exhaust port 45. In this case, what is necessary is just to constitute so that it may illustrate to solid-state macromolecule mold fuel cell 10J of the modification of drawing 22, and piping which supplies air from a feed hopper 31, and piping supplied from an exhaust port 35 can be switched. In solid-state macromolecule mold fuel cell 10J of a modification, the supply pipe 53 is connected to the fuel cell stack 20 exhaust-gas-pipe 68 side of the hydrogen content gas of J through a cross valve 55, 2nd supply pipe 56b, and cross valve 57b while connecting with the fuel cell stack 20 supply-pipe 63 side of the hydrogen content gas of J through a cross valve 55, 1st supply pipe 56a, and cross valve 57a. Moreover, exhaust gas pipes 58a and 58b are attached in cross valves 57a and 57b, and the exhaust-gas-pressure pressure regulating valves 59a and 59b are attached in exhaust gas pipes 58a and 58b.

[0038] Therefore, a cross valve 55 is operated so that a supply pipe 53 and 1st supply pipe 56a may be open for free passage. If cross valve 57b is operated so that 2nd supply pipe 56b and exhaust gas pipe 58a may not be open for free passage while operating cross valve 57a so that exhaust gas pipe 58b and 1st supply pipe 56a may not be open for free passage, air Since fuel cell stack 20J are supplied through 1st supply pipe 56a from a supply pipe 53 and it is discharged from exhaust gas pipe 58a, it becomes the pattern illustrated to drawing 5. On the other hand, a cross valve 55 is operated so that a supply pipe 53 and 2nd supply pipe 56b may be open for free passage. If cross valve 57a is operated so that 1st supply pipe 56a and exhaust gas pipe 58b may not be open for free passage while operating cross valve 57b so that exhaust gas pipe 58a and 2nd supply pipe 56b may not be open for free passage, air Since fuel cell stack 20J are supplied through 2nd supply pipe 56b from a supply pipe 53 and it is discharged from exhaust gas pipe 58b, it becomes the pattern illustrated to drawing 7. As explained above, in solid-state macromolecule mold fuel cell 10J of this modification, the pattern illustrated to drawing 5 and the pattern illustrated to drawing 7 can be switched. Consequently, according to the operational status of solid-state macromolecule mold fuel cell 10J, it can operate as a more suitable pattern. In addition, although the oxygen content gas side separator 30 illustrated to drawing 4 and the hydrogen content gas side separator 40 were used in solid-state macromolecule mold fuel cell 10J of a modification Are good also as a thing using oxygen content gas side separator 30B illustrated to drawing 12, or hydrogen content gas side separator 40B. Or it is good also as what uses the oxygen content gas side separator 30 and hydrogen content gas side separator 40B, or uses oxygen content gas side separator 30B and the hydrogen content gas side separator 40.

[0039] As mentioned above, although the form of operation of this invention was explained using the example, as for this invention, it is needless to say that it can carry out with the form which becomes various within limits which are not limited to such an example at all and do not deviate from the summary of this invention.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the outline of the composition of the solid-state macromolecule type fuel cell 10 as one example of this invention.

[Drawing 2] It is the block diagram which illustrates a part of fuel cell stack 20 of the solid-state macromolecule type fuel cell 10 of an example.

[Drawing 3] It is the cross section which illustrates the cross section of the direction of a field of the electrolyte film 22.

[Drawing 4] It is the plan which illustrates the field in which the oxygen content gas passageway 34 of the oxygen content gas side separator 30 is formed.

[Drawing 5] It is explanatory drawing which illustrates typically the situation of the supply at the time of supplying air and hydrogen content gas to the oxygen content gas side separator 30 or the hydrogen content gas side separator 40.

[Drawing 6] It is explanatory drawing which illustrates the situation of change of the pressure of the air in the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 in case the solid-state macromolecule type fuel cell 10 of an example is in operational status, or hydrogen content gas.

[Drawing 7] It is explanatory drawing showing typically the situation of the supply at the time of supplying air and hydrogen content gas to the oxygen content gas side separator 30 in a modification, or the hydrogen content gas side separator 40.

[Drawing 8] It is explanatory drawing which illustrates the situation of change of the air of the oxygen content gas passageway 34 of operational status, or the hydrogen content gas passageway 44 in a modification, or the pressure of hydrogen content gas.

[Drawing 9] It is explanatory drawing showing typically the situation of the supply at the time of supplying air and hydrogen content gas to the oxygen content gas side separator 30 in a modification, or the hydrogen content gas side separator 40.

[Drawing 10] It is explanatory drawing showing typically the situation of the supply at the time of supplying air and hydrogen content gas to the oxygen content gas side separator 30 in a modification, or the hydrogen content gas side separator 40.

[Drawing 11] It is explanatory drawing showing typically the configuration method which arranges the oxygen content gas side separator 30 and the hydrogen content gas side separator 40 so that the oxygen content gas passageway 34 and the hydrogen content gas passageway 44 may intersect perpendicularly.

[Drawing 12] It is explanatory drawing which illustrates oxygen content gas side separator 30B of a modification.

[Drawing 13] It is explanatory drawing which illustrates typically the pattern of the arrangement at the time of using oxygen content gas side separator 30B of a modification, and hydrogen content gas side separator 40B.

[Drawing 14] It is explanatory drawing which illustrates typically the pattern of the arrangement at the time of using the oxygen content gas side separator 30 of an example, and hydrogen content gas side separator 40B of a modification.

[Drawing 15] It is explanatory drawing which illustrates typically the pattern of the arrangement at the time of using oxygen content gas side separator 30B of a modification, and the hydrogen content gas side separator 40 of an example.

[Drawing 16] reinforcement of a modification — a member — it is explanatory drawing which illustrates arrangement of 24C

[Drawing 17] reinforcement of a modification — a member — it is explanatory drawing which illustrates arrangement of 24D

[Drawing 18] reinforcement of a modification — a member — it is explanatory drawing which illustrates arrangement of 24E

[Drawing 19] reinforcement of a modification — a member — it is explanatory drawing which illustrates arrangement of 24F

[Drawing 20] reinforcement of a modification — a member — it is explanatory drawing which illustrates electrolyte film 22G using 24G

[Drawing 21] It is explanatory drawing showing fuel cell stack 20H of a modification typically.

[Drawing 22] It is the block diagram showing the outline of the composition of solid-state macromolecule mold fuel cell 10J of a modification.

[Description of Notations]

10 10J A solid-state macromolecule type fuel cell, 20, 20H, 20J Fuel cell stack, 21 A cell, 22, 22C, 22D, 22E, 22F, 22G Electrolyte film, 24, 24C, 24D, 24E, 24F, 24G A reinforcement member, 26 Cathode, 28 30 An anode, 30B Oxygen content gas side separator, 31, and 31B feed hopper, 32 A rib, 32B 34 Heights, 34B Oxygen content gas passageway, 35 35B An exhaust port, 36 A rib, 38 40 Cooling-medium passage, 40B Hydrogen content gas side separator, 41 41B A feed hopper, 42 A rib, 44 Hydrogen content gas passageway, 45 45B An exhaust port, 52 A blower, 53 A supply pipe, 54 Supply-pressure pressure regulating valve, 55 A cross valve, 56a The 1st supply pipe, 56b The 2nd supply pipe, 57a, 57b cross valve, 58, 58a, 58b Exhaust gas pipe, 59, 59a, 59b An exhaust-gas-pressure pressure regulating valve, 63 A supply pipe, 64 A supply-pressure pressure regulating valve, 68 An exhaust gas pipe, 69 Exhaust-gas-pressure pressure regulating valve.

[Translation done.]

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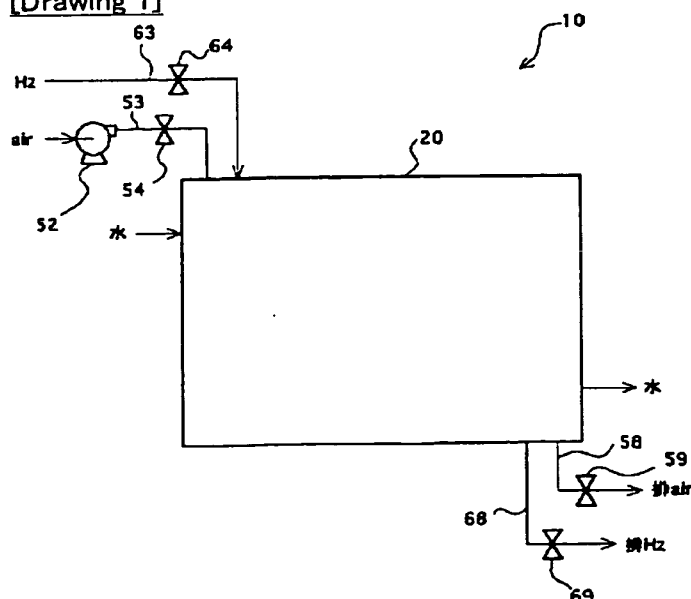
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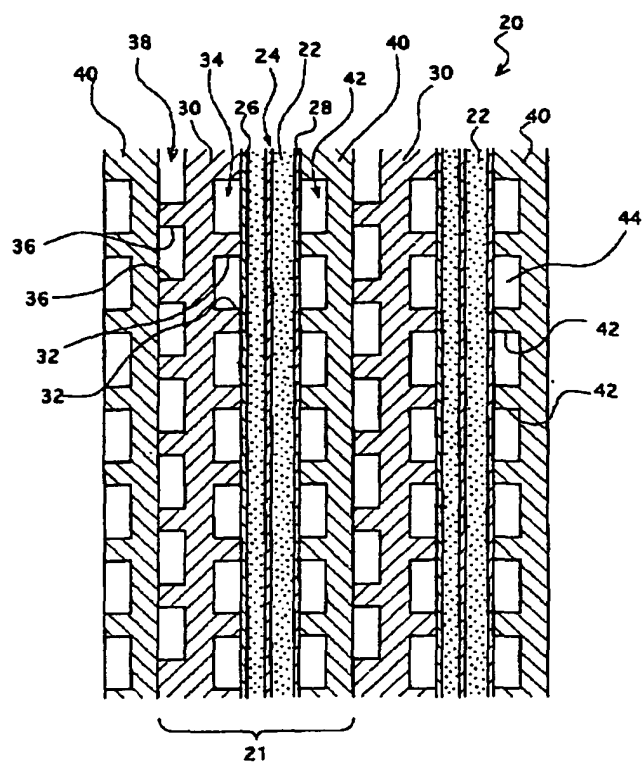
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DRAWINGS

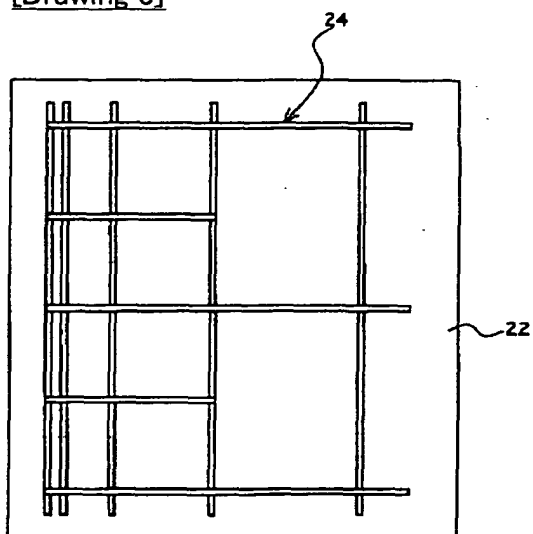
[Drawing 1]



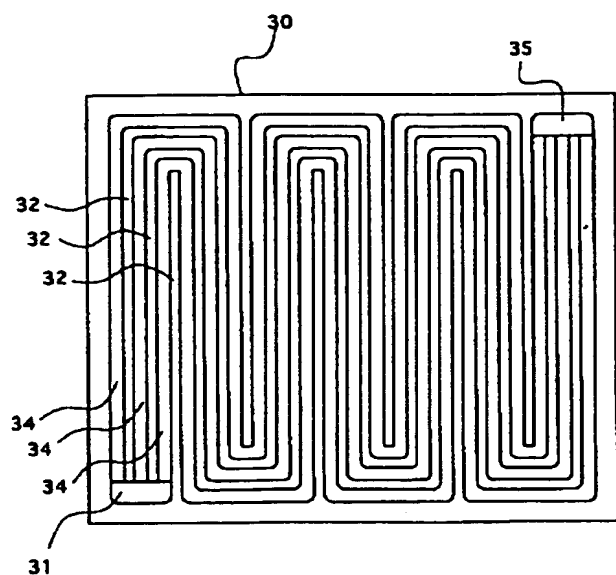
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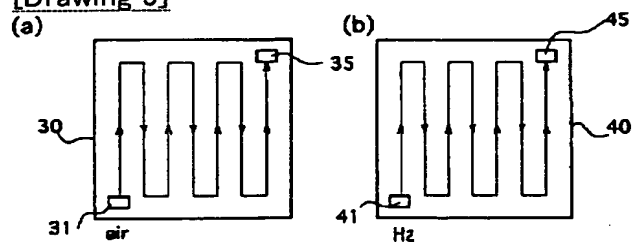
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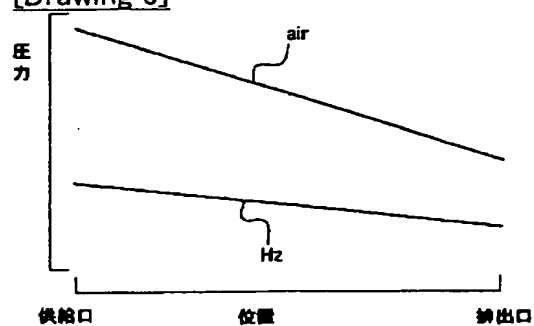
[Drawing 4]



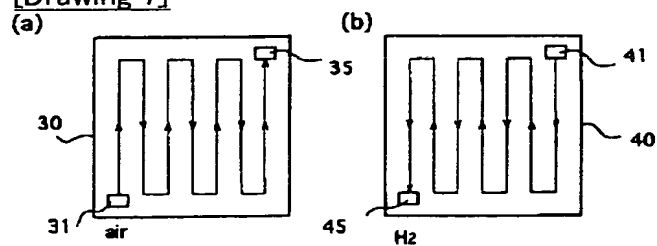
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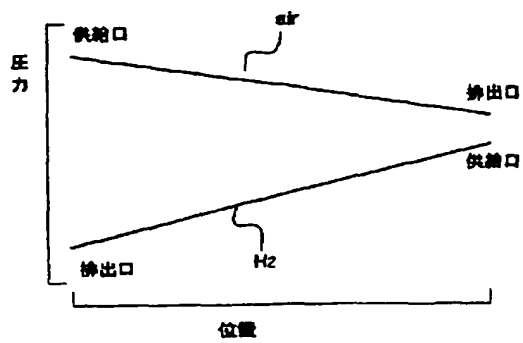
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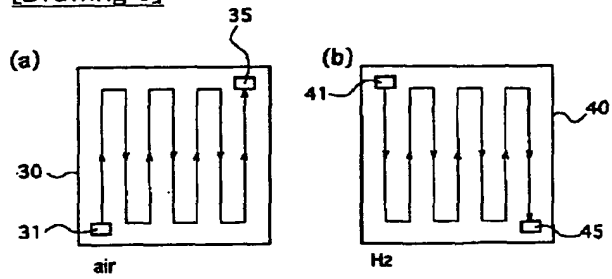
[Drawing 7]



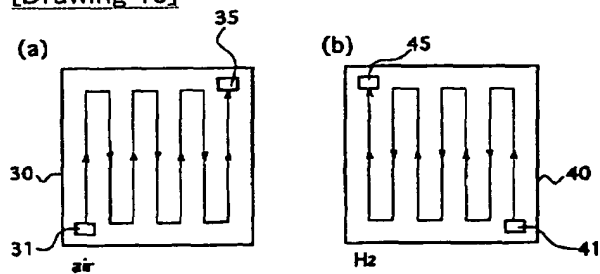
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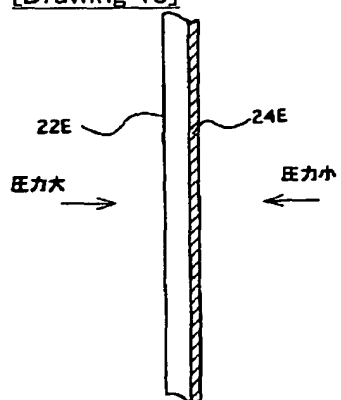
[Drawing 9]



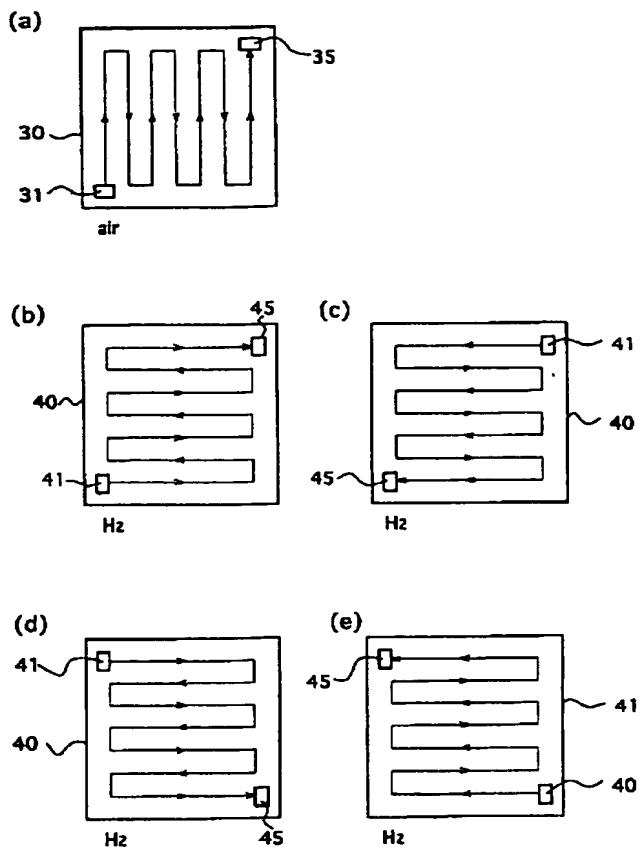
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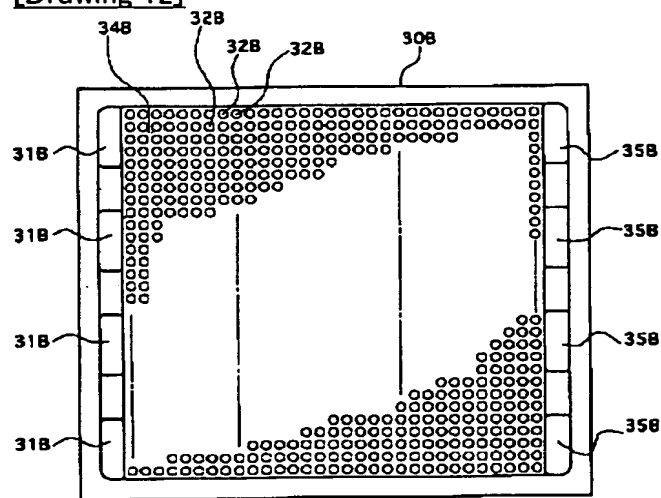
[Drawing 18]



[Drawing 11]

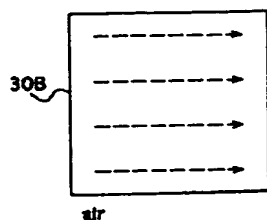


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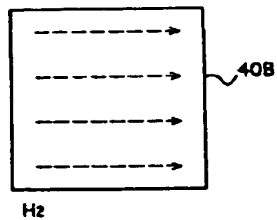


[Drawing 13]

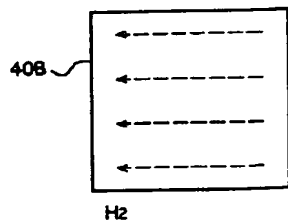
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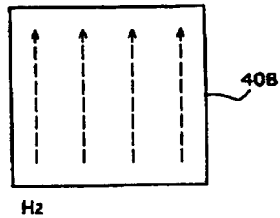
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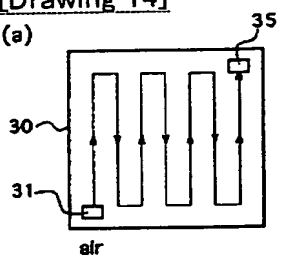
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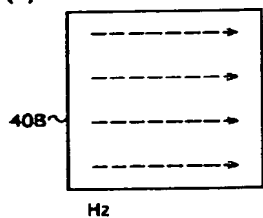
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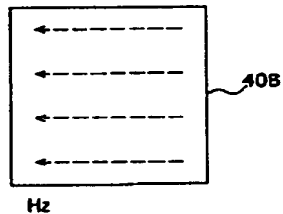
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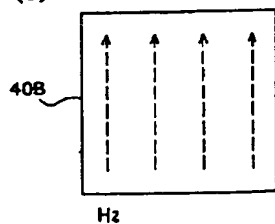
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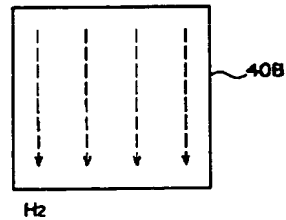
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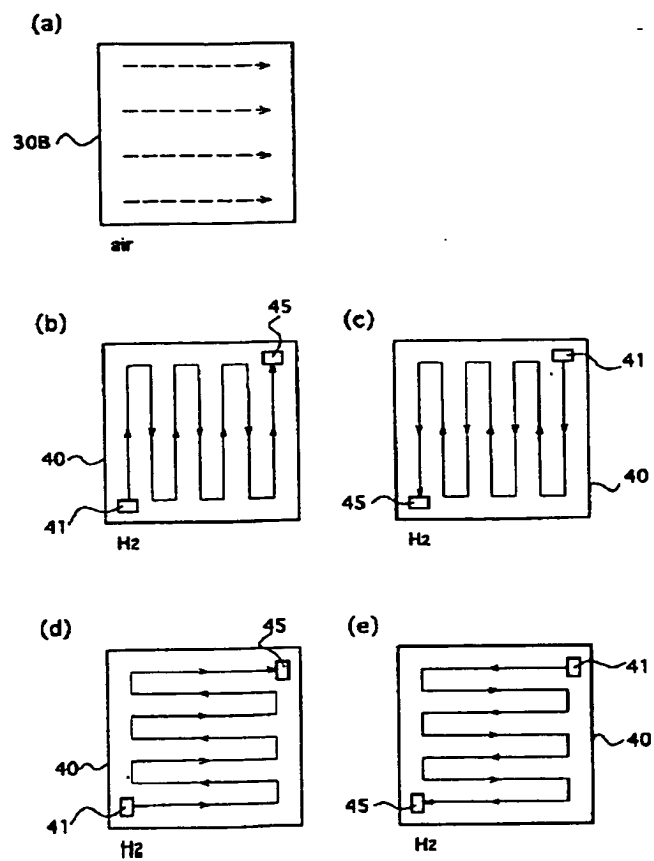
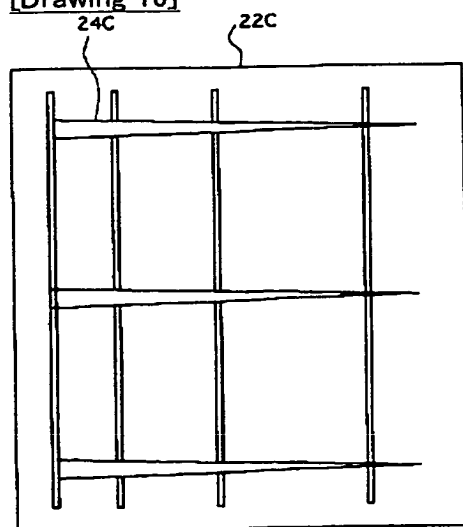


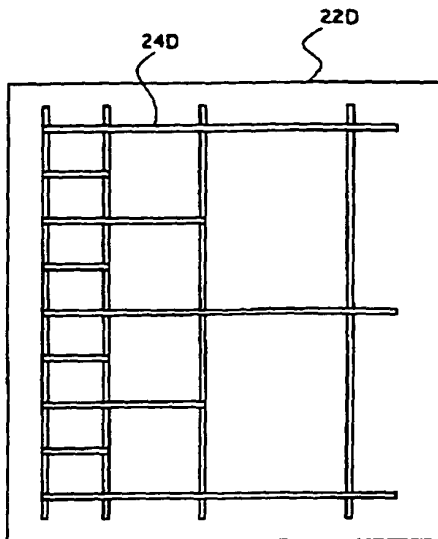
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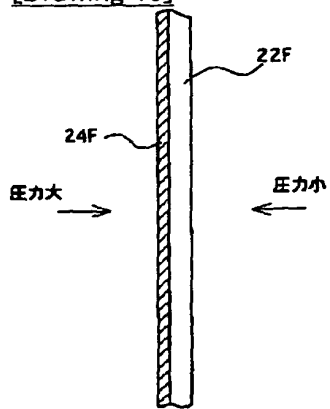
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[Drawing 15]

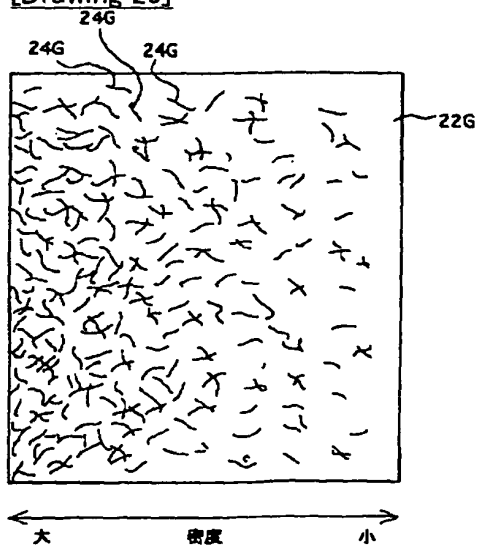
[Drawing 16][Drawing 17]



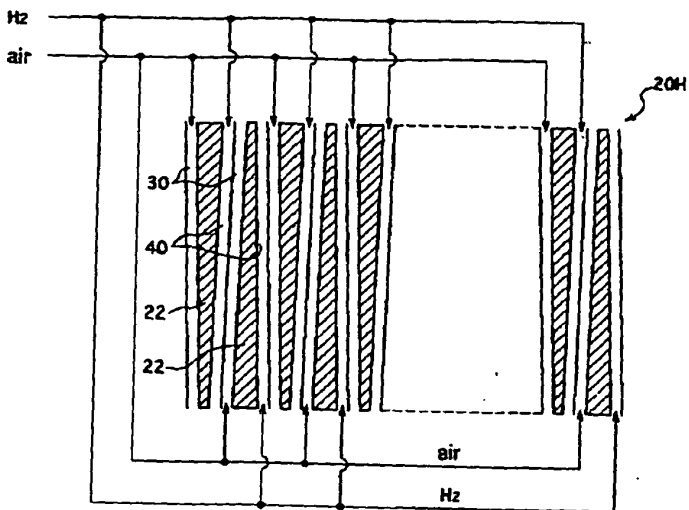
[Drawing 19]



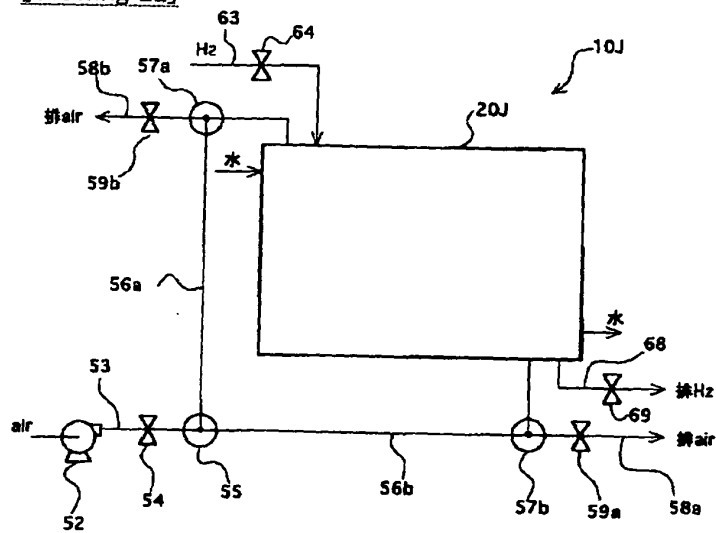
[Drawing 20]



[Drawing 21]



[Drawing 22]



[Translation done.]